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GOVERNMENTAL INTERFERENCE WITH PRODUCTION AND DISTRIBUTION.

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ANOTHER factor of the economic disturbance of recent years (i. e., since 1873), and one which, in the opinion of the members of the British Commission "On the Depression of Trade and Industry" (1886), and also of most European writers, has been largely instrumental in occasioning universal depression of business, has been the increasing tendency among nations to favor and practically carry out the policy, that the prosperity of their respective people can be best promoted by artificially stimulating domestic industries on the one hand, and imposing restrictions on international commerce or the free interchange of products with foreign nations on the other.

After the repeal of the "Corn Laws" by Great Britain in 1846, and the subsequent gradual abandonment by that nation of its former illiberal commercial policy—followed, as were these measures, by a remarkable development of British trade and industry—the tendency of popular sentiment and the policy of governments throughout the civilized world was unquestionably in the direction of emancipating international trade from all arbitrary restrictions; and between 1854 and 1870 the leading nations negotiated numerous treaties for international commercial reciprocity for the achievement of this object, and at the same time materially reduced their duties on imports. This movement (as is now almost forgotten), first found expression in the form of positive legislation in the United States, which in 1854 negotiated a treaty which provided for a free exchange of nearly all crude materials, and mutually free fishery privileges with the British provinces of North America; and, in 1857 (by a vote of 33 to 12 in the Senate, and 124 to 71 in the House) reduced its average duty on all

imports to less than 15 per cent. In fact, had not civil war intervened in 1861, the United States, in a very few years more, would have undoubtedly rivaled Great Britain in freeing its foreign trade and commerce from all restrictions, save for revenue and sanitary purposes.* In 1860, England, under the lead of Mr. Cobden, negotiated the celebrated commercial treaty with France, which, while providing for large reciprocal reductions or entire removal of many duties on exports as well as imports, also entirely abolished all absolute "prohibitions" on any branch of international commerce between the two nations; as, for example, in respect to coal, the exportation of which to France, England, under a fancied military necessity, had at one period prohibited.

Following the Anglo-French treaty, and as the result, doubtless, of its influence, twenty-seven other similar treaties were negotiated; in some one or more of which all the states of Europe, with the exception of Greece, participated; Russia even breaking through her customary reserve, and entering into more liberal commercial agreements with more than one of her neighbors. And, as many of these different treaties successively embodied new and special relaxations in respect to duties on imports—which, in virtue of the so-called "favored-nation clause"† existing in most previous treaties with other countries, became also and at once generally applicable—the area of commercial freedom and its accruing benefits extended very rapidly, and, as it were, without effort, over the greater part of Europe. So that, by the year 1870, "all the great trading nations of Europe—England, France, the states of the German Zollverein, Austria, Italy, Holland, and Belgium—had become one great international body, by all the members of which the principle of stipulating for exclusive advantages for their own commerce *seemed* to have been abandoned, and not one of whom could take off a duty without every other member at once enjoying increased commercial facilities; while within this body, the operation of the favored-nation clause was such as to make the arrival at almost unlimited freedom of exchange merely a question of time."‡

Furthermore, not only were these same governments busy during

* In 1860 a reduction of the national revenues, induced primarily by the commercial panic of 1857 and an increase of national expenditures, with threatened political troubles, led to the introduction of a bill, avowedly with the intent of restoring the tariff rates in force prior to 1857; and this bill, with amendments, increasing the rates considerably beyond that point became a law in March, 1861. But, at that date, seven of the Southern States had seceded, and had withdrawn in great part their Senators and Representatives from the Federal Congress; so that the action of Congress, at the time of the passage of this bill, affords no indication of what the legislation of the United States on the subject of the tariff would have then been had domestic tranquillity not been interrupted.

† By the "favored-nation clause" is understood that provision which has been incorporated in most treaties in modern times, by which the contracting parties agree to give to each other as good treatment as each one, then or thereafter acting severally, may give to other and the most favored nations.

‡ Address of the President (Grant Duff, M. P.) of the Department of Economy and

this period in breaking down the artificial barriers which they had previously erected against international trade, but they also sought, as never before, to overcome the natural impediments that had hitherto limited the extension of their trade relations—internal as well as external—by improving their highways, constructing and combining railways, and undertaking such stupendous engineering operations as the St. Gothard and Arlberg tunnels.

How wonderfully the trade of the states of Europe, that thus mainly co-operated for promoting the freedom of exchange, coincidently developed, with an undoubted corresponding increase in the wealth and prosperity of their people, is shown by the fact that the European trade of the six nations of Austria, Belgium, France, Holland, Italy, and Great Britain increased, during the years from 1860 to 1873, more than 100 per cent, while their aggregate population during the same period increased but 7·8 per cent. How much this remarkable increase of trade was due to the existence and influence of the commercial treaties noted, is demonstrated by the further fact that the increase of the trade of the above-named six nations during the same period with all other countries, in which the conditions of exchange had presumably not been liberalized, was at the rate of only 66 per cent. It is also interesting to note that the response made by the Chambers of Commerce and various industrial bodies throughout France to an inquiry addressed to them by the Government in 1875, not only testified to the great benefit which had accrued to French trade and industries by reason of her commercial treaties, but also expressed an almost universal wish that they might be renewed upon their expiration upon even a more liberal basis; and it is altogether probable that a similar response would have been made in most of the other countries in Europe had like inquiries at the same time been instituted.

But, after the continuance for some years of the almost universal depression of trade and industry which commenced in 1873, or after the year 1876, the tendency of the governmental policy of the states of Continental Europe, and to a great extent also popular sentiment, turned in an opposite direction, or toward commercial illiberality. And now nearly all of the liberal commercial treaties above referred to have been terminated, or notice has been given of their non-renewal; and, with the exception of Great Britain, Holland, Sweden and Norway, Denmark,* and possibly China, there is not a state in the world claiming civilization and maintaining commerce to any extent with

Trade, at the annual meeting of the British Association for the Promotion of Social Science, October, 1875.

* Denmark must be regarded as a purely agricultural country, possessing no mineral resources or mining population, and very few manufactories, "and while one half of the population live exclusively by agriculture, the industries and various branches of general trade and commerce afford occupation to less than one fourth of the whole number."—*Testimony British Commission on the Depression of Trade and Industry.*

foreign countries which has not within recent years materially advanced its import or export duties.

Russia commenced raising her duties on imports in 1877, and has continued to do so until the Russian tariff at the present time is in a great degree prohibitory, and one of the highest ever enacted in modern times by any nation, the aggregate value of its importations for 1886 being returned at only $194,450,000, a reduction of about 25 per cent in three years, or since 1883. It is also to be noted that, whenever Russia extends its dominion, laws are at once promulgated with the undisguised purpose of greatly restricting or entirely destroying any commerce which people of the newly-acquired territory may have previously possessed with other nations. Italy and Austria-Hungary raised their tariffs in 1878; Germany in 1879; France in 1881; Austria-Hungary again in 1882 and 1887; Switzerland in 1885; the Dominion of Canada in 1883 and 1887; Roumania in 1886; Belgium and Brazil in 1887; while in the United States, owing to the decline in the prices of goods subject to specific duties, the average *ad-valorem* rate of duty on dutiable merchandise has advanced from 41·61 per cent in 1884 to 45·55 per cent in 1886. In Spain the restrictions on trade have become so excessive, that the only relief open to the consumer is by alliance with the contrabandist, whose profession is becoming almost as well established as in the middle ages, when but for him, according to Blanqui, commerce would have well-nigh perished. In Holland, which has hitherto resisted all demands for increased restrictions on her foreign commerce, an association of manufacturers petitioned the Government in May, 1887, in favor of speedy legislation on the tariff, for the purpose of protection to home industries, and set forth the following as reasons for their request:

> The national industry lives in a most difficult time. It seems that the last period of the battle of life has appeared for many of its branches. Foreign competition, steeled by protection, equipped and encouraged to a decisive battle for the overpowering of a market for the world, even appears to drive aside the most natural protections of native industry. Now flour has its turn; next, cattle and meat. In other words, the aim of adjacent and more distant countries appears daily more openly. The industry of the Netherlands is menaced with a total ruin by their oppression.

And, as further illustrations of the degree to which a restrictive commercial policy is favored, and the extremes to which it is practically carried, it may be mentioned that some of the small British islands of the West Indies (Trinidad and St. Vincent, for example) maintain duties in a high degree restrictive of the interchange of their comparatively small products; while Venezuela, in 1886, when new and prospectively rich alluvial deposits of gold were discovered within her territory, at once imposed a duty of £5 ($25) on her exports of "raw gold."

To many, doubtless, these economic phenomena do not appear to

admit of any ready and satisfactory explanation; while others will unhesitatingly ascribe them to the influence and acceptation of protectionist theories and teachings, inculcated under the advantageous but specious circumstance, that the almost universal depression of trade and industry that has prevailed since 1873 commenced at a time when the general commerce of the world was absolutely more free from artificial restrictions than at any former period of its history.

The factors that have been concerned in effecting these economic changes and accompanying disturbances are not, however, simple, but somewhat numerous and complex. They, nevertheless, admit, it is believed, of clear recognition and statement. In the first place, the results of the Franco-German War—the radical changes in the character and construction of war-armaments since that period, and the continual augmentation of permanent military forces, have entailed upon all the states of Europe since 1873 continually increasing expenditures and indebtedness; and indirect taxation, by means of duties on imports, to meet these increasing financial burdens, has been found to be most in accord with the maxim attributed to Colbert, that the perfection of taxation consists in so plucking the goose—i. e., the people—as to procure the greatest amount of feathers with the least possible amount of squawking.

Again, with the introduction and use of new, more effective, and cheaper methods or instrumentalities of production, every nation of advanced civilization has experienced, in a greater or less degree, an increase in the product of nearly all its industries save those which are essentially handicraft in character, with not only no corresponding increase, but often an actual decrease in the number of laborers to whom regular and fairly remunerative employment constitutes the only means of obtaining an independent and comfortable livelihood. Every country with accumulating productions has accordingly felt the necessity of disposing of its surplus by exporting it to the markets most freely open to it; and, as a consequence, that has happened which might have been expected could the exact course of events have been anticipated, namely; increased competition in every home market, engendered by increasing domestic production and the efforts of foreign producers to export (introduce) their surplus; fiercer competition to effect sales of the excess of competitive products by the sellers of all nations in neutral markets; and an almost irresistible tendency toward a universal depression of prices and profits, and, to a greater or less extent, a displacement of labor. It is also to be noted that as the capacity for industrial production increases, and competition to effect sales becomes fiercer, the more feverish is the anxiety to meet competition—spècially on the part of foreign rivals—by producing cheaper goods; and that this policy in the states of Continental Europe, and more particularly in Germany, is antagonizing efforts to shorten the hours of labor and restrict the factory employment of women and

children; and is also tending in a marked degree to do away with the heretofore general practice of suspending labor on Sundays.*

To meet this condition or tendency of affairs, two lines of policy have commended themselves to the governments of many countries—especially in Continental Europe—as remedial and easy of execution, namely; to seek to diversify and increase the home demand for the products of domestic industry on the one hand, and to obtain new and larger markets in foreign countries for their surplus productions on the other. And the *first* of these results it has been sought to accomplish by restricting or prohibiting, through import (tariff) duties, the importation and competitive sale in their respective markets of the surplus products of other nations; and the *second*, by offering bounties on exports, or on the construction and multiplied use of vessels for employment in foreign commerce. In the pressing necessity for finding new and (if possible) exclusive markets for increasing machinery products, and for commodities whose production has been artificially stimulated, is undoubtedly also to be found the clue to the policy which within recent years has mainly prompted Germany, France, Belgium, Italy, and Spain to seek to obtain new territorial possessions in Eastern and Central Africa, Southeastern Asia, and in New Guinea and other islands of Polynesia.

The commercial policy of Russia under such circumstances must,

* The results of an extensive inquiry recently instituted by the British Government in respect to Sunday labor in Germany (and comprising with the evidence taken three large volumes) shows, that in Westphalia, Rhineland, Würtemberg, Baden, Alsace, and Brunswick Sunday work is only enforced where necessary. Different reports come, however, from Saxony, one stating that "Sunday labor has become usual in most factories and workshops solely under the stress of competition, so that the hours of divine service are now alone excluded, and these only from absolute necessity." Another report says, that Sunday labor has become "a principle with many employers," while in a number of cases the journeyman or operative seeking an engagement must bind himself to work on Sunday, and "if the workman refused to work on Sunday, reprisals on the part of the employer would be the inevitable result, and this is so, even in spite of the legal restriction of work on Sundays and festivals." "On the whole," says the "London Economist," "the evidence" (presented in the published report of the Government inquiry) "is unfavorable to the principle of Sunday labor, though it is largely carried on—in all probability more so than is admitted, for in innumerable cases it is admitted that it is hard to get at the real state of affairs. Nevertheless, there is general disinclination against putting the principle of no Sunday work into practice where the objectionable system has obtained a footing. On the part of large industrial concerns, it is said that want of continuity would often be a cause of serious loss, while without Sunday labor repairs could never be carried out, even night-work being no adequate substitute. The number of associations which recommend the absolute prohibition of Sunday labor is small in proportion to those which advocate partial prohibition. The question of Sunday labor is one of considerable interest for England, for it is unquestionable that, among the causes of Germany's ability to compete with England as a mercantile and industrial country, the fact that here more hours are worked for less money is not the least important. The prohibition of Sunday labor would, of course, mean increased cost of production; and every increase in the cost of production will render it more difficult for Germany to outrival older manufacturing countries in the markets of the world."

however, be regarded as wholly exceptional, and that of the United States as partially so. In the case of the former, her recent increased restrictions on foreign commerce, through greatly increased duties on imports, have not, apparently, been due to the acceptance of any economic theory in respect to trade, or with any reasonable expectations that an extensive prohibition of imports could permanently add to her revenues from customs; but rather because such action is an essential part of what seems to be a larger and fully accepted national policy, which aims to banish and exclude from the empire everything foreign in its nature and origin—merchandise, language, literature, immigration, and religion. While in the case of the latter the fiscal policy of the country for now more than a quarter of a century has been based upon the idea that foreign trade is injurious, and therefore importations, without which there can be no exportations, should be prevented.

Leaving Russia out of account, the nation that took the initiative in breaking in upon the system of comparatively free international exchanges that had gradually come to prevail among the commercial nations of Europe since 1860 was Austria-Hungary, which, feeling the necessity of securing larger markets for her manufactured products, increased her tariff in 1878, with the avowed expectation of obtaining, through new negotiations, greater commercial advantages or concessions, more especially from Germany, than were enjoyed under existing treaties. A similar policy also found favor at about the same time in France, and under its influence the "Anglo-French" and other commercial treaties were either allowed to lapse or were "denounced," and a new general tariff was constructed. The result was not what was probably anticipated. Increased restrictions on imports on the part of Austria, in place of inviting concessions led at once to retaliatory tariffs by Italy and Germany, and the example thus set has been followed by one European Continental state after another, each raising barrier after barrier against the competition of other nations, until all stability of duties on the numerous frontiers has practically ended, baffling the calculations alike of exporters and importers, and making the development of almost every trade and industry dependent on bounties, subsidies, and restrictions on exchanges, rather than on their own inherent strength and enterprise.

The following examples are illustrative of recent procedures in continuation of this policy: In 1885 Germany deliberately excluded Belgian linen from her markets. This act has not as yet been followed by reprisals by Belgium; but the action of Germany, in twice augmenting in recent years her duties on breadstuffs (i. e., 1880 and 1885), has been promptly imitated by Austria-Hungary, whose export of cereals was seriously affected. But, notwithstanding these increased duties on the movements of grain between Germany and Austria, the prices of cereals in both of these countries have since continually re-

ceded. In July, 1887, Russia increased her duties—which were before very high—on the imports of all foreign iron and steel, to a point that is regarded as nearly or quite prohibitory of all imports; and Germany, which has heretofore had an important market for her iron and steel wares in Russia, and has also been a large purchaser of Russian grain, has now determined to further advance her duties upon the import of all foreign cereals, her object being avowedly to shut out American as well as Russian competition. Belgium, which for many years has been the typical free-trade state of the world, and which, in 1885, by her Chamber of Deputies, refused to entertain a proposition to restrict the importation of cattle into the country, has since then, and mainly by a recognition of an inability to compete with the prices established for meats and grain by the United States and other foreign countries, felt compelled to impose high duties on the importation of all live-stock and dead meats—fresh, smoked, or salted.

In Sweden and Norway, on the other hand, where, during the past year, an effort was made under similar circumstances to restrict by increased duties the entry of foreign flour and other breadstuffs, the proposition was signally defeated by the return of a large adverse majority to the lower house of the Swedish Riksdag. A new tariff, embodying the extreme protective principle recently adopted by Brazil, imposes high and almost prohibitory duties on the importations of rice and all other cereals produced in the country, and, as Brazil has heretofore imported annually some two hundred thousand sacks of rice from foreign countries, the disturbance of trade in this particular is likely to be serious.

The United States having imposed heavy duties on the importations of French wines and silks, France improves on the precedent thus established, and excludes by relatively higher duties the importation into her territories of American pork. The Helvetic Confederation, in negotiating with Germany for a renewal of a treaty of commerce, broadly intimates that unless the result of negotiations is satisfactory it will take measures to check the importation of German merchandise in the future into Switzerland; while the termination by original stipulation of a treaty of commercial reciprocity between France and Italy in 1887, has been regarded with feelings of unmixed satisfaction by many persons in both countries, by reason of the opportunity that is to be afforded for mutually increasing the duties on their respective importations. A somewhat striking illustration of the present drift of popular sentiment in France on this subject is also to be found in the fact, that in July, 1887, the French Government, by a formal decree, absolutely prohibited the future importation of "plants, flowers, cut or in pots, of fruits, fresh vegetables, and, in general, of all horticultural and market-garden produce of Italian origin"; chestnuts without their shells excepted.

It is further most interesting to note how, as the idea of the de-

sirability of restricting trade and commerce is accepted and carried out, the larger idea of the middle ages, that restrictions should be imposed, not merely on the freedom of commercial intercourse between country and country, but also between districts of the same country, and even between man and man, tends to reassert itself and demand recognition and acceptance; as is demonstrated by a variety of incidents on both sides of the Atlantic. In this movement in Europe, France at present takes the lead. Thus, for example, French workmen and employers are apparently now in unison of opinion, that all foreigners shall be rigidly excluded from any kind of work done by or for the Government, and from furnishing any kind of supplies for the public service. Among the bills recently brought forward in the French Chamber of Deputies, and which have received the serious attention of the Government, one provides that only French coal shall be used in the navy, and only French oats in the army; and, in general, that nothing of foreign growth or production shall be bought for public use, except such articles as are not produced in France. Clauses in existing treaties with foreign nations and apprehensions of reprisals have, it is believed, alone prevented the project of imposing special and differential taxes on all foreign workmen. The committee in charge of the French International Exhibition of 1889, while invoking the co-operation and good feeling of other countries, have restricted all bids for buildings to French firms exclusively, ruling out all foreign firms from participation in the work, even though established in France, and employing only French workmen. The ancient *guild* system of the middle ages, restricting craft-membership and the employment of apprentices, and claiming the right to exclusively regulate prices, hours of labor, and other conditions of service, is also everywhere re-establishing itself; the glaziers of Paris leading the advance in this direction, by formally petitioning the authorities for incorporation as a guild, to which no foreigner shall be admitted, and no one not a member, even if he be a Frenchman, shall be allowed to set glass or make repairs upon windows in French territory. In a discussion of the labor-problem at a recent Catholic Congress in Belgium, the Bishop of Liege is reported as saying that the old trade-guilds must be revived and placed under the guardianship of Christian lay employers and of the clergy. Then each trade or calling must be placed under the special protection of a saint; and brotherhoods of those engaged in it, composed both of employers and workmen, must be formed for the celebration of the saint's *fête* and for participation in religious processions and funerals, and the rendering of mutual assistance in times of need. But it was also remarked, that while labor was pretty sure to indorse the recommendation of the revival of the guild, it would be equally sure to wholly disregard the ideas of the bishop as to the uses that should be made of it. It should also not be overlooked in this connection, how closely, and yet perhaps unintentionally, the

modern labor organizations—"Trades Unions," "Knights of Labor," and the like—have come to resemble and be assimilated to the ancient "*guilds*"; with this marked difference, that in the old craft-guilds, the masters or employers of labor remained in and participated in the organization; but in the modern organizations of labor, the masters or employers are especially excluded.

In Germany the extensive intervention of the state in industrial and social matters has come to be, in recent years, a fundamental policy of the Government; and is resulting in a series of experiments for controlling or even entirely absorbing great industries—as sugar and distilled spirits—and for promoting the economical and moral prosperity of the people—as schemes for compulsory insurance of life and against accidents—which have hitherto had no precedents in the legislation of any country. At the same time, in all these movements the Government makes no secret of its desire in fostering the interests of the people to at the same time augment their ability to pay taxes.

In the United States, the recent action of the French Government, in providing that nothing shall be bought for public use which is not of domestic production, and which the outside world has regarded as a policy unworthy of an enlightened nation, has had its counterpart and precedent in the previous legislation of quite a number of the States; with this exception, that in France the discrimination is made against foreigners only, while in the United States the discrimination is made against their own countrymen living in different political divisions of the country. Nothing, moreover, can probably be found in Europe to parallel the recent legislation of one of the leading States of the Northwest (Minnesota), and a large part of which was the work of a single legislative session (limited to sixty days) in 1885, and which has thus been described by a recent writer:* Prominent in importance were statutes providing for the weighing, handling, and inspection of grain; the construction and location of grain-warehouses, the providing of cars and side-tracks by railroads, and the regulation of rates of transportation. Next, was legislation respecting State loans of "seed grain" to farmers whose crops had been ruined by grasshoppers; for the subsidizing of State fairs from the State treasury; for enabling farmers to avoid the payment of a portion of their debts; for protecting butter-makers from the competition of artificial products, such as "butterine"; for regulating the details of the cattle-industry, to the extent of registering and giving State protection to brands and other modes of identification, and of stamping out contagious diseases with small courtesy to the rights and wishes of individual owners; and for regulating the lumber-business to such an extent, that not a log can float down a stream to the saw-mill for which it is destined without official cognizance. One State board regulates the practice of medicine and the admission of new

* "The American State and the American Man," Albert Shaw, "Contemporary Review," May, 1887.

practitioners; a second, the examination of druggists and compounding clerks, as precedent to entering into business; while a third regulates the practice of dentistry. Various enactments prescribe the toll to be exacted for grinding wheat; when one man may slay his neighbor's dog with impunity; how railway companies must maintain their waiting-rooms at their stopping-places for passengers; the hours of labor, and the employment of women and children; the maximum time for which locomotive engineers and firemen may be continuously employed; what books shall be used in the public schools; forbidding "raffles" at church fairs under "frightful penalties," and making it a crime to give away a lottery-ticket, and a misdemeanor "to even publish an account of a lottery, no matter when or where it has been conducted." Among bills introduced, and which found considerable support, but were not enacted, was one forbidding persons of different sexes to skate together, or even be present at the same hour on the rink floor; and another to license drinkers, which provided that no person should be permitted to use intoxicants or purchase liquors of any kind without having first obtained a public license.

The result of such a conflict of tariffs as has prevailed in Europe since 1877–'78 has entailed so much of commercial friction, such a series of retaliatory measures, and such an arrest of material development, that there are now many signs that the continuation of this state of affairs will not be much longer endurable. In this conflict, Austria, which was the first country that broke in upon the International Commercial Union that prevailed among the Continental states prior to 1878, has suffered most severely; her exports and imports having notably decreased, while her customs taxes have risen in recent years from 1*s.* 8*d.* to 3*s.* 7*d.* per head of her population, and her internal taxes on consumption from 3*s.* 7*d.* to 6*s.* 8*d.* There has been a marked decline in banking profits, an increase in the mortgages on real property, and a decline in the consumption both of meat and of farinaceous articles of food. To such an extent has her fiscal policy invited reprisals that she is described as "standing alone commercially," and reduced to the position of consuming her own products through necessity. Russia having sought to close her doors against the produce of other countries, they in their turn have curtailed their purchases of Russian products, the falling off of Russian imports—comparing 1886 with 1883—having been nearly 25 per cent, and of exports 28 per cent. Of flax, which is one of the principal exports of Russia, the decline in the value of shipments has been from $29,350,000 in 1884 to $19,250,000 in 1886. The German Chambers of Commerce, in their recent reports, have, with very few exceptions, declared against the present tariff policy as most injurious to the industry and commerce of the empire. The recent prohibitory duties decreed by Russia on the importation of iron and steel have closed numerous iron-furnaces in Silesia, and the steam corn-mills of Northern Germany are complaining

of a great check to their business by reason of the duties on the import of cereals. The recent report of the Stuttgart Chamber of Commerce earnestly urges the Government to improve trade by a return to its former reciprocal conditions.*

The idea that a few years ago found great acceptance in Europe, and undoubtedly influenced the commercial policy of the different states—namely, that increased restrictions on the importation and competitive sales of foreign products and the resort to bounties on exports would conjointly stimulate industries, relieve their markets from anything like overproduction, and inaugurate a period of general prosperity—has utterly failed of realization, and been entirely different from what was anticipated. And for the following reasons: The stimulus being artificial, was unnatural. Production rapidly increased, and soon created an additional supply of articles, which were already produced in the localities best fitted for their production, in quantities sufficient, or more than sufficient, to meet any existing market demand at remunerative prices, thus occasioning an augmentation of the very evils which it was expected the restrictive commercial policy would prevent, and which may be enumerated in their sequential order somewhat as follows: 1. Overproduction in the natural seats of production. 2. Domestic competition to effect sales destructive of all profits. 3. Special concessions of prices to effect sales in foreign countries which have been disturbing to the legitimate industries of such countries. 4. A general depression of prices, and the reduction of business profits to a minimum; all resulting in a condition of affairs which two years ago is said to have drawn out from Count Karolyi, the Prime Minister of Austria, the assertion, that "the European states, by their present retaliatory tariffs, are doing themselves more injury than the most unrestricted international competition could possibly inflict."

It seems to be also now generally conceded in Germany and other states of Europe that the depression of business and the disturbances occasioned by the fall of prices, which were most influential in inducing the general reaction in favor of protective duties in 1878, were due to causes that were not to be reached by such remedies, and that

* "The result of the intensive and extensive development of the protective system," observes the Stuttgart Chamber of Commerce, "notwithstanding its beneficial influences on many branches of industry, has been to doubly increase the international uncertainty which now burdens trade and commerce. Every movement in favor of protective duties results in efforts on the part of each country interested in the matter to outbid its neighbor; and the very duty which is expected to protect a nation produces a reaction on home prices, and causes them to become assimilated to those of international commerce." This Chamber believes that the prospect of a lasting improvement in trade would "be better grounded could only further exactions in international customs tariffs be avoided, and the uncertainty of market-price, which is the outcome of the protective system, be removed by an equitable establishment of mutual customs and commercial relations, by an increased stability and certainty of the duration of tariffs, and by a reciprocal return to former conditions."

the same continue operative to-day in spite of all the customs barriers against international trade that have been erected. All the indications, furthermore, are at present in favor of a renewal of commercial treaties or alliances between the Continental states, with a view through mutual concessions, of establishing better trade-relations between the participating powers than now exist; and the announcement has been made that preliminary negotiations for this purpose have begun between Germany and Austria and Germany and Italy. One project proposed, by Professor Kaufmann, of the University of Tübingen, which has been much discussed, and the adoption of which, in the opinion of not a few, is not improbable, is the formation of a Zollverein, or commercial union, among the nations of Central Europe, with a view, as the "Kölnische Zeitung" (which is regarded to some extent as an official organ of the German Government) has expressed it, "of expanding their markets by means of treaties, so that the surpluses at any one place within their dominions may serve to make up for the deficiencies in another," and which, more especially, would "find its account in collectively fighting against economical commonwealths, like the United States, Russia, China, and Great Britain, which embrace whole continents." *

The attempt to artificially stimulate the manufacture of beet-sugar in the states of Continental Europe, and at the same time to obviate the evils from the production of this commodity in excess of local or domestic demand by the payment of bounties on its exportation, has constituted such an extraordinary factor of disturbances in the world's recent economic history as to be worthy of special narration and attention.

Although the practice of stimulating through high protective duties and export bounties the production of beet-root sugar in Europe in competition with the cane-sugar product of the tropics dates back to the first quarter of the century, the present complicated and curious state of affairs is really due to an unexpected result of the German method of taxing beet-sugar, which was adopted in 1869. The idea involved in this method was, in brief, to collect an excise or internal-revenue tax on all sugar produced; in the first instance by taxing the raw beets, and subsequently to give a drawback on whatever sugar was exported equivalent to the tax paid on the beets from which the sugar was made. At the outset about twelve pounds of beets were

* Such a formation of the "United States of Europe"—this phrase being borrowed from the "Kölnische Zeitung"—coupled with the avowed objects to be prospectively attained by it, would have a peculiar significance for the United States of America, as the feeling in Europe in respect to the export trade of the United States in respect to food-products has not been and is not now friendly. "The prohibition of her hog-products, the successive additions to the duties on grain and cattle, and the readiness with which any complaint against an American staple is taken up and widely circulated, often in a grossly exaggerated form, are indications of what would be the position of such a customs union toward the United States, could it become an accomplished fact."

required to make a pound of sugar, and on this basis the drawback was calculated; or for every hundred-weight of sugar exported, there was granted a drawback of nearly twelve times the tax paid on each hundred-weight of beets. For a number of years after 1869 this arrangement worked well, the drawback being about equivalent and no more than the tax. But nothing stimulates human ingenuity in a greater degree than the prospect of gain through the avoidance of a tax; and gradually a change in the condition of affairs took place. By careful and scientific cultivation the saccharine element in the beet was so much increased and the mechanical and chemical methods of extracting it so greatly perfected, that while in 1869 twelve pounds of beets were needed in the average German factories to make one pound of sugar, in 1878 the requisite quantity was 10·78 pounds; in 1882, 10·08 pounds; in 1884, 9·28 pounds; in 1886, 8·80 pounds. The effect of this was to make the drawback on the exports of sugar no longer equivalent to the tax, and convert it into a bounty; or the exporter received a drawback as if he had paid an excise-tax on twelve pounds of beets, when in reality he had paid on a much smaller quantity—less than nine pounds after 1885. The fact that this bounty was accruing was not unknown to the German Government; but as it became especially manifest during the years 1876–'79, when the great depression of industry had developed a strong protectionist feeling, nothing was done to stop it; but on the contrary it was popularly regarded with satisfaction. Under such favorable circumstances, the beet-root sugar product of Germany increased with great rapidity; and as the amount soon far exceeded any requirements for domestic consumption, and as a net profit of from 6 to 7 per cent was guaranteed to the manufactories by the export bounties, the exportations soon assumed gigantic proportions, rising from about 500,000 cwt. in 1876 to over 6,000,000 cwt. in 1885. The other states of Continental Europe, finding the markets for their own product of beet-root sugar everywhere supplanted by the German sugars and their domestic manufacturers being even thereby brought to the verge of ruin, made haste to follow the example of Germany, and improve upon it, by offering larger bounties for the domestic production and export of sugars than were offered elsewhere; until the policy of Germany, France, Belgium, Holland, Austria, and Russia during recent years, seems to have been to stimulate their domestic product of sugar to the greatest extent, and then enter into competition with each other to see which of them could sell cheapest to foreigners at the expense of their own people; the home-grown sugars of France and Germany, for example, selling, it is reported, in England for about one half the prices paid for the same article by the French and German people.*

* In 1883–'84, Germany, at an estimated cost of about $7,000,000 in the way of export bounties, exported more than three fifths of her annual product of beet-sugar.

The Russians determined nearly forty years ago to make their own sugar out of beet-root, and at first encouraged their manufacturers with a specific bounty. Subsequently they substituted for the bounty an almost prohibitory duty on imports, and under this system the production of beets and sugar increased rapidly for many years, with large resulting profits to producers. In 1881 the Russian manufacturers produced just enough to satisfy the demands of the home market. In 1882 there was an excess of production. Prices then began to fall and manufacturers to fail. They could not export their surplus at a profit, because they could not compete in foreign markets. More protection at home was not wanted, because the protection existing was complete. Under these circumstances application was made to the Government to pay them for exporting their surplus, and this the Government agreed to do, to the extent of giving a bounty of one rouble per pood * on an exportation that was to be limited to two million poods, with a remission also of all internal taxes on the same. This arrangement continued until January, 1886, when, the Russian market being overstocked with sugar, an extension of the bounty on an unlimited exportation was demanded, and granted by the Government for a period of about six months, or until July, 1886. The result was that the Russian exporters poured upon the English and Italian markets (the only ones readily available to them) during this brief time, and to the great disturbance of the world's markets, sugar to the amount of seven and a half million poods (227,000,000 pounds), leaving still three million poods surplus at home unsold and unsalable. The present French export bounty on sugars is estimated at from 5*s.* to 10*s.* ($1.20 to $2.40) per cwt., entailing an annual expense to the treasury of at least $15,000,000. As the French refiners, however, obtain a great quantity of untaxed raw sugars, the actual annual loss to the Government is believed to be much greater. The present export bounty in Germany is 2*s.* per cwt., and the present annual treasury expenditure, in order that foreigners may have cheap sugar, is believed to be about 37,733,796 marks, or $9,334,000. For the year 1885–'86, Austria is supposed to have paid $8,000,000; Belgium, $4,000,000; and Holland, $1,330,000, on account of sugar-export bounties. The United States, in this business of selling sugar cheap to foreigners at the expense of their own people, has also played a not undistinguished part, the exports of refined sugars having risen from 22,227,000 pounds in 1881 to 252,579,000 pounds in 1885, or 26,000,000 pounds in excess of the entire cane-sugar product of the country for the latter year. The secret of this probably was, that a bounty was paid under the guise

Of this exportation a large part went to the United Kingdom, where the average consumption of sugar for that year was in excess of seventy pounds per capita, as compared with an average of seventeen pounds for the population of Germany.

* The Russian pood equals 35 English pounds, and the single silver Russian rouble may be reckoned at 60 cents.

of a drawback, which the English sugar-refiners estimated at 39 cents per 100 pounds. This drawback having been reduced by the Treasury Department to 17 cents, the exports for the succeeding year, 1885–'86, at once fell off to 164,339,000 pounds.

The experiences that have followed this attempt, on the part of practical statesmen, to interfere with the natural progress and development of a great industry, constitutes one of the most instructive chapters in all economic history. Judged from certain standpoints, the bounty system, as applied to beet-root sugar, has been unquestionably most successful. It has increased the aggregate product of this variety of sugar so rapidly that, in place of constituting 20 per cent of the whole sugar-product of the world, as it did in 1860, it now represents at least 56 per cent of such aggregate. This artificially increased product of sugar has so far exceeded the current demands of the world for the consumption of this commodity, that sugar now ranks, in point of retail value, with such articles as oatmeal, barley, and flour; and it has even been proposed that it should be utilized as food for cattle, or as a fertilizer in competition with artificial manures. Comparing wholesale prices, sugar was 114 per cent higher in 1880 than the first half of 1887. Such a reduction in the price of a prime necessity of life has been of immense advantage to consumers. In Great Britain, whose policy since 1874 has been to give her people sugar free of taxation, the per capita consumption has risen from 56 pounds in that year to 75 pounds in 1886 (as compared with a per capita of about 54 pounds in the United States in 1885); while the saving to the British people, from the reduction of the cost of this one item of their living, in the single year of 1886, has been estimated by a good authority (Mr. Samuel Montague, M. P.) as high as £11,000,000 ($55,000,000). Again, the bounty policy developed a large local industry in many of the states of Continental Europe, and for a time paid enormous profits to manufacturers and refiners producing for export, as is believed to be yet the case in France, and which has recently increased its duties on the imports, and its bounties on the exports, of sugar, and which latter are now three times greater than those paid by Germany. During the year 1886 the profits of the two leading sugar-refiners of France from export bounties, exclusive of their domestic trade, were reported as about £450,000 ($2,225,000) each; but how much of this they were required to part with in order to force, through reduced prices, the sales of their product in other countries, is, of course, not known. It is claimed to have greatly injured the sugar-refining industry of Great Britain; but, on the other hand, it is declared to have given a great impetus to the business of manufacturing confectionery, preserved fruits, jams, etc., in that country; industries which have given employment to many more persons than were ever occupied in refining sugar.

But there is another side to this picture. Under the influence of

an extraordinary and artificial stimulus more sugar has been produced than the world was ready to absorb, even at the reduced prices which the bounties made possible. The price of beet-root, and therefore of all sugar, has continued to decline, until the sugar-industry of Continental Europe (with the possible exception of France), is suffering under the severest depression. Many establishments have closed or passed into bankruptcy, and it is now well understood that the only profit available to the manufactories is that derivable from so much of their product as is exported, which, in the case of Germany, represents more than half of the annual production. In a recent discussion in the German Reichstag, Deputy Heine opposed the continuance of the present bounty system in that country, upon the ground that it was disastrous to the agricultural laborer, who had been compelled to sacrifice all his land to the beet-cultivators. These cultivators, who farmed upon a large scale, had effected many improvements in labor-saving machinery, and thus reduced the laborer's wages to a minimum; so that in some districts the laborers were little better off than serfs. At the same time the people of the sugar-producing states of Europe uniformly pay more for what proportion of their own sugars they consume than is paid by foreigners on the proportion exported. In Russia, where the depression is extreme, the manufacturers have petitioned the Government, but thus far unsuccessfully, to restrict production by law to whatever extent would be necessary to keep the price up to the point at which it stood when the domestic product was just sufficient to supply the home market; or, in other words, to permit production to continue at the producer's discretion, but not to allow him to sell anything over the regulation amount in the home market. The disaster which the extreme artificial reduction in recent years in the price of sugars has brought to other great business interests and to the material prosperity and even civilization of large areas of the earth's surface, can not well be overstated. In Barbadoes (British West Indies), in February, 1887, it was estimated* that the loss at that time on every ton of sugar produced and exported to London was £1 15*s.*, and in the absence of all profit on what is almost the sole industry of the West Indies, it would seem as if civilization would disappear from many of the islands, as indeed it already has in a great degree from some of them—the island of Tortola, for example, which was, comparatively a few years ago, the seat of a profitable sugar-industry. In the Spanish islands of Cuba and Porto Rico, the taxation of sugar, mainly export duties, have hitherto constituted an important source of revenue, but within a recent time Spain, as a condition for saving the planters from ruin, has felt obliged to relinquish most of them. In Java, the situation of the sugar-industry is so deplorable that, in order to save it from destruction, with the consequent throwing of half a million of Javanese laborers out of employment, and thereby increas-

* "Barbadoes Agricultural Reporter," February, 1887.

ing the already large number of Malay pirates, the Dutch ministry, in 1886, decided, besides making advances to planters on their crops, to purchase from their colonial planters five eighths of their production at a price that would entail a sacrifice on the Dutch treasury of about 40,000,000 francs, or $8,000,000.* And since then it seems to have been well established, that German beet-root sugar has been and is now exported half round the globe, and largely sold in Singapore, the center of the great sugar-producing countries of Asia, at a price which makes its use to the manufactories of preserved fruits more advantageous than the sugars of Java and the other islands of the Indian Archipelago. A like exportation of Continental sugars, artificially reduced in price, to Australia, also threatens with ruin the developing cane-sugar industry of these countries.

Finally, the states of Continental Europe, in which the burden of taxation is already most grievous, and in most of which there is a regular and increasing annual deficit, are beginning to feel that they can no longer endure the strain upon their finances which the bounty-paying system to their sugar-industries entails, and which has not brought prosperity to them or the state. In this reaction, Russia has taken the lead, and is stopping her bounties as rapidly as possible; and all the other states exhibit unmistakable evidences of a desire to follow her example. The difficulty, however, is that so much of their respective sugar-industries as has been called into existence artificially would be immediately ruined, with great loss and suffering to a large number of people, if the bounties were at once discontinued; and the same result would follow by the putting an end to any possibility of exporting, if one, or all but one, of the states should cease paying bounties, and one, like France, should continue to do so. Earnest efforts are accordingly being made for the holding of an international congress, with the object of agreeing upon a mutual abandonment of the bounty system; and the official announcement has been made by the British Government that Austria-Hungary, Germany, Holland, Italy, Spain, Belgium, and Denmark have agreed to participate; Russia and France having not as yet declared themselves on the subject of attendance.

In face of this experience, the Government of the Argentine Republic has determined to appropriate an annual sum of $550,000 for three years, in order to stimulate the export trade of that country in beef and mutton for the European market.

The recent experience of France in attempting to stimulate ship-building and ship-using, through a carefully-devised system of subsidies and bounties, furnishes another illustration of the effect of gov-

* "Journal des Fabricants de Sucre," October, 1886.

A further idea of the depression of the sugar-trade in Java may be gained from the fact, that the imports of raw sugar from the island by Holland have declined—comparing the results of the year 1870 with those of 1885—about 90 per cent.

ernmental interference with the natural course of industries, second in importance only to that afforded by the experience of sugar.

Thus, to accomplish the purpose above noted, the French Government offered in 1881 to give a bounty of $12 a ton on all ships built in French yards of iron and steel; and a subsidy of $3 per 10 tons for every 1,000 miles sailed by French vessels; and as they did not desire to put any inhibition on the citizens of France buying vessels in foreign countries and making them French property, in case they desired to do so, they proposed to give one half the latter subsidy to vessels of foreign construction bought by citizens of France and transferred to the French flag.

At the outset, as was the case with the sugar bounties, the scheme worked admirably. New and extensive steamship lines were organized with almost feverish haste, and the construction of many new and large steamers was promptly commenced and rapidly pushed forward in various French ports, and also in the ship-yards of Great Britain and other countries. The Government paid out a large amount of money, and it got the ships. In two years their tonnage increased from a little over 300,000 to nearly 700,000 tons for steamers alone; while the tonnage engaged on long voyages increased in a single year from 3,600,000 to over 4,700,000 tons.

It was probably a little galling to the French to find out after two years' experience that most of the subsidies paid by the Government were earned by some 200 iron steamers and sailers, and that over six tenths of these were built and probably owned in large part in Great Britain; so that the ship-yards on the Clyde got the lion's share of the money. But as all the vessels were transferred to and sailed under the French flag, and were regarded as belonging to the French mercantile marine, everything seemed to indicate that the new scheme was working very well, and that the Government had really succeeded in building up the shipping of France. But the trouble was that the scheme did not continue to work. The French soon learned by experience the truth of the economic maxim, that ships are the children and not the parents of commerce; and that while it was easy to buy ships out of money raised by taxation, the mere fact of the ownership of two or three hundred more ships did no more to increase trade, than the purchase and ownership of two or three hundred more plows necessarily increased to a farmer the amount of arable land to plow; or, in other words, the French found that they had gone to large expense to buy a new and costly set of tools, and then had no use for them.

And, what was worse, they found, furthermore, that while they had not increased trade to any material extent, they had increased the competition for transacting what trade they already possessed. The result has been that many French shipping-companies that before the subsidy system were able to pay dividends are now no longer able; fortunes that had been derived from the previous artificial pros-

perity have melted away; the French mercantile marine has ceased to grow; and the whole scheme has proved so disastrous a failure that the late Paul Bert, the eminent French legislator and orator, in a speech in the French Assembly, seriously undertook to defend the French war of invasion in Tonquin, on the ground that its continuance would afford employment for the new French mercantile marine, which otherwise, we have a right to infer, in his opinion would have remained idle.

The experience of the mercantile marines of Europe during recent years affords the following curious results: It shows, *first*, that the payment of bounties has practically availed nothing in arresting the continued decrease in sailing-tonnage; *second*, that in the eight years prior to 1880, French shipping, in its most valuable branch—steam—increased faster than the shipping of any of its Continental competitors; but after 1880, the increase in the steam-marine of Germany, where no bounties were paid, was relatively greater both in number and tonnage of vessels than in France where large bounties were given after 1881; and was also greater as respects the aggregate tonnage of all vessels—sail and steam. The obvious expectation of the French Government in resorting to the bounty system for shipping was that ships built and navigated with the aid of the bounties, would carry French manufactures into foreign countries, and thus open new markets for domestic products. But experience, thus far, has shown that all that has been effected is a transfer, to some extent, of the carriage of goods formerly brought in foreign vessels, to French vessels. But, on the other hand, the increase of tonnage, under the stimulus of the bounties, beyond the requirements of traffic, and the consequent reduction of freights, has entailed "a loss, and not a gain to the French nation; by throwing upon it the burden of a shipping interest that, but for the Government aid, would have been unprofitable, and which, because of such aid, can not conform itself to the demands of trade." *

The experience of Great Britain, occupying as she has, the position of being the only country in the world of *large* production and commerce which has not within recent years imposed restrictions on the competitive sale of foreign products in her markets, is also exceedingly interesting and instructive. That British trade and production has been injured by attempts in the nature of forced sales on the part of competitors in protected countries to dispose of their surplus products in the English duty-free markets—while the tariffs of their own countries have shielded them from reprisals—and that from like causes Great Britain has experienced severe foreign competition in neutral markets where British trade had formerly almost exclusive possession, can not be doubted. Thus, the report of the British Commission "On the Depression of Trade and Industry" (1886) shows that the importation

* "Report on the Mercantile Marines of Foreign Countries," by Worthington C. Ford. U. S. Department of State Ex. Doc., 1886.

of foreign manufactured or partially manufactured goods into Great Britain has increased since 1870, at "a slightly more rapid rate" than the increase of its population, having been £1·97 per head in the period 1870–'74, and £2·35 per head in the period 1880–'84. The extent of the injury to British interests from these changes in the conditions of the world's trade, does not, however, appear to have been as great as might have been anticipated, or as is popularly supposed; and very curiously has manifested itself in a reduction of profits, rather than in any reduction of the volume of British trade; the value of British exports to the six protectionist countries of the world—the United States, France, Germany, Russia, Spain, and Italy—having been larger during the years 1880–'84 than in any quinquennial period of British history, with the exception of the period from 1870–'74, when British trade is known to have been abnormally inflated. It is also not a little interesting to note that the countries of the world in which, according to the most recent and accepted statistics, the ratio of wealth and the ratio of foreign commerce to the population are the greatest, are Holland and Great Britain, the two states that have emancipated themselves in the greatest degree from all restrictions on the interchange of products with foreign nations—the customs revenue of the former amounting to about one per cent on her imports, and that of the latter to about five and a half per cent.* In India, also, where there are few artificial restrictions on the freedom of exchange, internal trade, manufactures, and foreign commerce have increased in an extraordinary degree within recent years, and the wages of skilled labor have also, at the same time, notably advanced.

An analysis of the comparative values of the export trade of the nations of Europe during the five years from 1880 to 1885—a period of intense struggle for the domination of the world's markets—affords the following interesting results: In cotton and woolen yarns and dry-goods, England has strengthened her position; in iron and steel goods, her share of the world's trade has increased from 64·2 to 66·5 per cent; while in machinery her exports have been pushed up from 66·7 to 69·1 per cent. In glass and glass goods England's percentage remained constant, while that of France and Belgium declined. Germany increased her exports of glass and glassware, and also very largely of paper, and slightly of machinery, losing ground in respect to the exportation of iron and steel goods, in common with France and Austria.

* It is popularly believed that the *per-capita* wealth of the people of the United States, which the census of 1880 fixed at $860—but which, allowing for duplications, is probably not over $500—is greater than that of any other people. This, however, is not the fact; the ratio of wealth to each inhabitant in Great Britain being $1,245, and in Holland, $1,200. The wealth of Holland, moreover, doubled in the twenty years next prior to 1880, while the gain in population of the country during the same period was comparatively insignificant. In respect to commerce, the ratio to each inhabitant, in 1880, was $150 in Holland, as compared with $91 for Great Britain, and $32 for the United States.

In leather and leather goods, Germany leads, while France appears to be rapidly losing her former supremacy.

Apart, however, from their bearing on any particular country, a review of all the circumstances connected with the multiplication of restrictions on international commerce, which the majority of civilized nations have united in creating in recent years, fully justifies the British Commission and other European authorities in regarding it as a most influential agency in occasioning almost universal economic disturbance. It has been progress backward—progress in the direction of that sentiment of the middle ages, which held that, as commerce benefited one country only as it injured some other, it was the duty of every country to impose the most harassing restrictions on its commercial intercourse. Or, in other words, increased knowledge respecting the forces of Nature, and a wonderful subordination and use of the same having greatly increased and cheapened the abundance of all useful and desirable things, the majority of the world's legislators and statesmen have seemed to have considered it incumbent upon them to neutralize and defeat the beneficent results of such abundance. And the most comforting assurance that progress will not indefinitely continue to be made in this same direction, is to be found not so much in the intelligence of the masses or their rulers, as in the circumstance that existing restrictions on commerce can not be much further augmented without such an impairment of international trade as would be destructive of civilization.

As the restrictions on trade within the last eight or nine years have not been all imposed at one time, but progressively, and as their influence has accordingly been gradual, the world does not seem to have as yet fully appreciated the extent to which the exchange of products between nations has been thereby interrupted or destroyed. But as the case now stands, Russia practically prohibits her people from any foreign purchases of any iron or steel; Germany and Austria, of cereals; Belgium, of cattle and meats; Russia, Austria, Germany, France, Belgium, and Holland, of sugar; France, of pork; and Brazil, of rice. The imports of Russia, as before pointed out, decreased twenty-five per cent in the three years from 1883 to 1886; those of France from $160,981,000 in 1881 to $127,457,000 in 1885; and those of Austria during the same period from $251,230,000 to $219,273,000. Between France and Italy trade has been interrupted to almost as great a degree as mutual governmental action will admit; while the value of the exports of the United States to France which amounted in round numbers to $100,000,000 in 1880, had become reduced in 1886 to $40,096,000. The one objective of the restrictive commercial legislation of all countries in recent years has been mainly the United States; and it has already affected the former agricultural supremacy of the country in the markets of the world; the exports of cattle from the United States, comparing 1886 with 1881, having

declined 35·8 per cent in quantity; of beef products 17·7 per cent, and of pork products 35 per cent. The exports of butter and cheese have also participated in the general decrease of exports.

THE ECONOMIC DISTURBANCES SINCE 1873 CONTINGENT ON WAR EXPENDITURES are not different in kind from those of former periods, but much greater in degree. This subject has been so thoroughly investigated and is so well understood, that nothing more need be said in this discussion, than to point out that the men in actual service at the present time in the armies and navies of Europe is in excess of 4,000,000, and that it undoubtedly requires the product of one operative or peasant labor, to sustain one soldier. The present aggregate annual direct war expenditure of the world is probably in excess of a thousand million dollars. We express this expenditure in terms of money, but it really means work performed; not that abundance of useful and desirable things may be increased, but decreased; not that human toil and suffering may be lightened, but augmented.

EVOLUTION AND RELIGIOUS THOUGHT.*

BY PROFESSOR JOSEPH LE CONTE.

FROM what has preceded, the reader will perceive that we regard the law of evolution as thoroughly established. In its most general sense, i. e., as a law of continuity, it is a necessary condition of rational thought. In this sense it is naught else than the universal law of necessary causation applied to forms instead of phenomena. It is not only as certain as—it is far more certain than—the law of gravitation, for it is not a contingent, but a necessary truth like the axioms of geometry. It is only necessary to conceive it clearly, to accept it unhesitatingly. The consensus of scientific and philosophical opinion is already well-nigh if not wholly complete. If there are still lingering cases for dissent among thinking men, it is only because such do not yet conceive it already—they confound it with some special form of explanation of evolution which they, perhaps justly, think not yet fully established. We have sometimes in the preceding pages used the words evolutionist or derivationist; they ought not to be used any longer. The day is past when evolution might be regarded as a school of thought. We might as well talk of gravitationist as of evolutionist.

If, then, evolution as a law be certain; if, moreover, it is a law affecting not only one part of Nature—the organic kingdom—and one department of science—biology—but the whole realm of Nature and every department of science, yea, every department of thought, chang-

* From advance sheets of Professor Le Conte's work on "Evolution and its Relation to Religious Thought," in preparation by D. Appleton & Co.

ing our whole view of Nature and modifying our whole philosophy, the question presses upon us, "What will be its effect on religious belief, and therefore on moral conduct?" This is a question of gravest import. To answer it, however imperfectly, is the chief object of this work. Except for this, it would probably never have been undertaken. All that goes before is subsidiary to this.

But I will doubtless be met at the very threshold by an objection from the scientific side. Some will say—because it is the fashion now to say—that as simple, honest truth-seekers, we have nothing to do with its effect on religion and on life. They say we must follow Truth wherever she leads, utterly regardless of what may seem to us moral consequences. This I believe is a grave mistake, the result of a reaction, and on the whole a wholesome and noble reaction, against the far more common mistake of sacrificing truth to a supposed good. But the reaction, as in most other cases, has gone much too far. There is a true *philosophic* ground of justification for the reluctance with which even honest truth-seekers accept a doctrine which seems harmful to society. Effect on life is, and ought to be, an important element in *our estimate of the truth of any doctrine.* It is necessary for me to show this in order to justify this part of my work.

There is a necessary and indissoluble connection between truth and usefulness. We all at once admit this connection in one direction. We all admit that a truth must eventually have its useful application. It may not be *now*, nor in ten years, nor in a century, nor even in a millennium, but sometime in the future it will vindicate its usefulness. No truth is trivial or useless in its relation to human life, for man is a part of Nature, and his life must be in accordance with the laws of Nature. Every one admits this, but not every one admits the converse proposition, viz., that whatever doctrine or belief, in the long run and throughout the history of human advancement, has tended to the betterment of our race, must have in it an element of truth by virtue of which it has been useful, for man's good can not be in conflict with the laws of Nature. Also, whatever in the long run and in the final outcome tends to the bad in human conduct, ought to be received, even by the honest truth-seeker, with distrust, as containing essential error. The reason of this will now be further explained.

There are three primary divisions of our psychical nature, viz., sensuous, intellectual, and volitional, or moral. There are three corresponding primary processes necessary to make a complete rational and satisfactory philosophy: (1) There is first the *instreaming* of the external world through the senses, as impressions. These we call facts or phenomena. (2) The elaboration of these facts within, by the *intellect*, into a compact constant structure. This we call knowledge. (3) The outgoing of this knowledge by the *will* into the world as right or wise conduct. Now these three are all equally necessary. All these three portions of our complex nature are equally urgent to be satisfied.

But, unfortunately, scientific workers are too apt to think only 1 and 2 necessary—that true facts elaborated into consistent theory are all we need care for. Theologians and metaphysicians, on the other hand, seem to think only 2 and 3 necessary. They elaborate a theory consistent in all its parts, exquisitely woven in beautiful and delicate pattern, and apparently satisfactory in its application to the right conduct of life, but are less careful to inquire whether it is in harmony with facts derived from the senses. But, we repeat, all three are equally necessary. The first gathers the materials, the second constructs the edifice, the third, by *use*, by practical application, *tests* whether it be a fit building to live in, whether it is constructed on sound architectural principles. The tendency of the olden time was to neglect the first; the tendency of the present time is to neglect the third. But we repeat with stronger emphasis that this third element is equally necessary. All admit that successful application in art is the surest test of the truth of science. Now, social conduct is the art corresponding to our philosophy of life, and therefore is the sure test of its truth. It follows, therefore, that unless all these three primary divisions of our nature are satisfied by any doctrine, there must result an ineradicable confusion and discord in our psychical nature, and cordial acceptance is not only impossible but irrational. We insist upon this the more because it has become the fashion in these latter days of dominance of science, to say that to inquire into effects on society is inconsistent with the scientific spirit, and unworthy of the honest truth-seeker. But, observe, I am speaking of effects on society only as a *test of truth*. I would not swerve a hair's breadth from absolute devotion to truth. It is necessary, indeed, to inquire into effects on society, but we must inquire only in the patient spirit characteristic of the truth-seeker. Whatever is really true will surely vindicate itself by its beneficence, if we will only wait patiently for final results. Evolution is no exception to this universal truth. It will surely vindicate its beneficence, but we must wait yet a little while —not very long.

So much it was necessary to say in justification of the inquiry which constitutes this third part of our work. But, after this justification, the question returns with additional emphasis, "What will be the effect of the universal acceptance of the law of evolution on religious thought, and through this on the right conduct of life?"

There can be no doubt that evolution, as a law affecting all science and every department of Nature, must fundamentally affect the whole realm of thought, and profoundly modify our traditional views of Nature, of God, and of man. There can be no doubt that we are now on the eve of a great revolution. But, as in all great revolutions, so in this, the first fears as to its effects are greatly exaggerated. To many, even friends and foes of Christianity, evolution seems to sweep away the whole foundation, not only of Christianity, but of all religion and

morals, by demonstrating a universal materialism. Many are ready to cry out in anguish, "Ye have taken away our gods, what have we more? Ye have destroyed our dearest hopes and noblest aspirations, what more is left worth living for?" But I think all who are at all familiar with the history of the so-called conflict between religion and science will admit this is not the first time this cry has been raised against science. They have heard this danger-cry so often that they begin to regard it as little more than a wolf-cry—scientific wolf in the religious fold. It may not be amiss, then, to stop a moment to trace rapidly the main points of this conflict—to discuss the various forms of this scientific wolf.

First, then, it came in the form of the *heliocentric theory of the planetary system*. We once thought the earth the center of the universe, and so firm that it can not be moved. But science shows that it moves about the sun, and spins unceasingly on its axis. Every one has heard of the terror of the sheep produced by this discovery, and the nearly tragic results to the bold scientist. But now we look back with wonder that there should have been any trouble at all. Would any Christian now consent to give up the grand conceptions of Nature and of God thus opened to the human mind—the idea of infinite space full of worlds, of which our earth is one, moving in silent harmony as in a mystic dance? Verily, this wolf has proved itself a harmless, nay, a very noble, beast, and lies down in peace with the lambs.

Next, it came in the shape of the *law of gravitation*, as sustentation of the cosmos by law and resident forces. The effect of this on religious thought was even more profound, though less visible on the surface, because only perceived by the most intelligent. It seemed at that time to remove God from the course of Nature. This was the real ground of the skepticism of the last century, and also the real motive of Voltaire's ardent advocacy of Newton's views before these were generally accepted in France. But now, who would give up this grand idea—this conception of law pervading infinite space—the same law which controls the falling of a stone guiding also the planetary orbs in their fiery courses? This is indeed the divine spheral music, inaudible but to the ear of science, accompanying the celestial dance.

Next, it came in the form of the *antiquity of the earth* and of the cosmos. The earth which we had fondly thought made specially for us about six thousand years ago; sun moon, and stars, which we had vainly imagined shone only for our behoof—these, science tells us, existed and each performed its due course inconceivable ages before there was a man to till the ground or contemplate the heavens. Some of my readers may still remember the horror, the angry dispute which followed the promulgation of these facts. But now, who would consent to give up the noble conception of infinite time thus opened to our human mind and become forever the heritage of man?

Next it came in the form of the *antiquity of man*. It is probable,

nay, certain, that man has inhabited the earth far longer than we had previously supposed we had warrant for believing. The fear of controversy on this question has indeed not yet entirely subsided. Some timid people still look askance at this wolf, but I think all intelligent people accept it and find it harmless.

Next, and last, it comes now in the form of *evolution*—of the origin of all things, even of organic forms, by *derivation*—of *creation by law*. We are even now in the midst of the terror created by this doctrine. But what is evolution but law throughout infinite time? The same law which now controls the development of an egg has presided over the creation of worlds. Infinite space and the universal law of gravitation; infinite time and the universal law of evolution. These two are the grandest ideas in the realm of thought. The one is universal sustentation, the other universal creation, by law. There is one law and one energy pervading all space and stretching through all time. Our religious philosophy has long ago accepted the one, but has not yet had time to readjust itself completely to the other. A few more years, and Christians will not only accept, but love and cherish this also for the noble conceptions it gives of Nature and of God.

But some will exclaim, "Noble conceptions of God, say you! Why, it utterly obliterates the idea of God from the mind. All other conflicts were for outworks—this strikes at the citadel. All others required only readjustment of claims, rectification of boundaries betwixt science and religion—this requires nothing less than unconditional surrender. Evolution is absolute materialism, and materialism is incompatible with belief in God, and therefore with religion of any kind whatsoever!" Before proceeding any further, it becomes necessary to remove this difficulty out of the way.

GLIMPSES OF LIFE ALONG A CORAL REEF.

By F. H. HERRICK.

LAST summer (1886) I spent the month of June, with a party of naturalists from Johns Hopkins University, on Green Turtle Key, a small coral island near Abaco, Bahama, where we were engaged in the study of marine invertebrate life. In order to learn more of the general flora and fauna of the reef, I visited many of its rocks and keys which stretch in a long, broken chain northeastward of Abaco and the submerged banks connected with it. My friend who accompanied me was especially interested in birds, and was anxious to obtain specimens of the eggs and skins of the sea-fowl which breed in great numbers on these remote islands.

Abaco Island is roughly crescent-shaped (as shown by the accompanying map), its two horns pointing about northwest and south.

With Little Abaco, which properly belongs to it, it is nearly one hundred miles long, and has an average width of twelve miles. There are six hundred and eighty square miles in the larger island alone. The greater part of its outer side, facing the ocean, is bordered by an inner reef of small keys and rocks, which trend northwest by southeast,

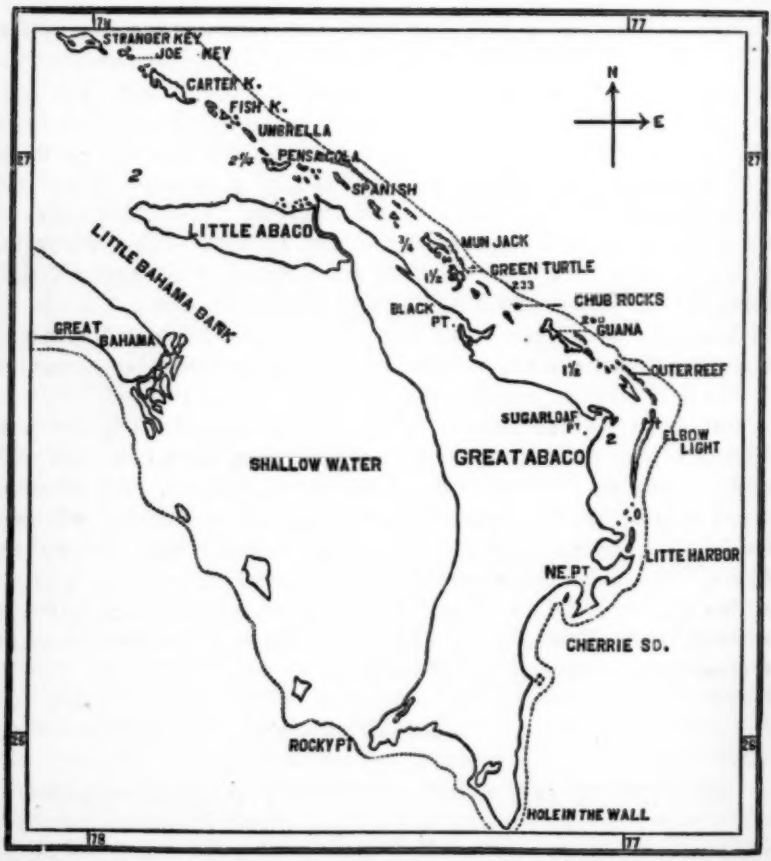


FIG 1.—MAP OF ABACO ISLAND AND ITS ADJOINING REEF. (From the latest United States Coast Survey Chart).

and form a channel about five miles wide, having a depth of from one to two and a half fathoms. Two or three miles farther out there is a second reef, mostly submerged, beyond which the bottom falls abruptly to the abyssal sea. The larger islands extend through one degree of latitude, from nearly 25° 50′ to 26° 50′.

We left Green Turtle on the 15th of June in a sail-boat, with two men to pilot and assist us. Our older guide, Curry, was a native of the island, and made his living by fishing and sponging. His services were invaluable, as he was not only invariably obliging, but knew every rock and key in the reef, and could readily tell them at a long

distance by their slight differences in contour. The position of our key, which we had left behind, was shown by the top of its tall cocoanut palms long after the island itself had dipped below the water. Taking a northwest course up the channel, Abaco is seen as a low barrier on our left, while at a greater distance it looks like an undulating green ribbon between the sky and sea. We pass numerous small keys

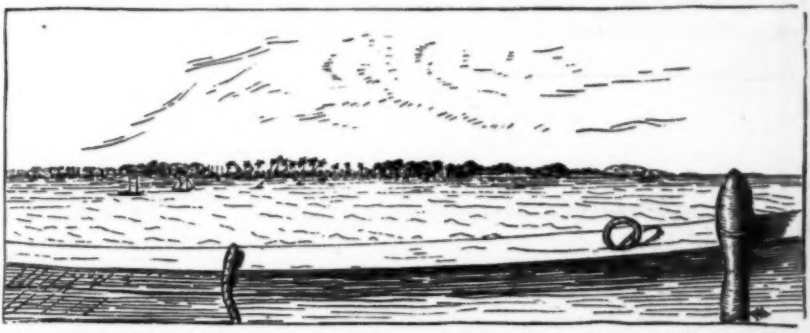


FIG. 2.—GREEN TURTLE KEY, BEARING THREE MILES NORTHEAST. (From a sketch made from the deck of a schooner.)

and rocks on the right, between which long white lines of breakers may be seen, marking the outer reef. We are frequently near enough to the "mainland" to see its dense forests of pine, its palms fringing the shore, the narrow beaches of white coral-sand, with here and there a thatched hut fronting a pineapple field, which may be distinguished by the small clearings in the woods.

The keys present the greatest variety in size and form, from a bare rock no larger than a buoy to islands five or six miles long. The latter are very narrow, and are usually covered with a thick growth of shrubs and small trees which, excepting a few palms, rarely exceed fifteen or twenty feet in height. The islands are scattered along closely together, or occasionally separated by wide channels. The soil has to be very thin indeed, which can not support a variety of shrubs, which seem to grow out of the very rocks and to live upon the air. Some of the smaller keys are mantled with vines and climbing plants, such as smilax, convolvuli, and rock samphire, with here and there some low shrubbery at the water's edge.

The coral-rock which forms the basis of the islands crops out at many points, and is always exposed around the shores where these are not covered by a sand-beach. Freshly-broken surfaces have a light-cream color, but weather to a uniform grayish tint. This limestone is so soft that it can be readily sawn or chopped with an axe. Consequently, the waves denude it rapidly, forming the white coral-sand, which is distributed as a fine deposit over the sea-bottom and as stretches of smooth beach. The shores overarch where they are at all precipitous, roofing a wide cavern below, in which the ceaseless roar of the waves may be heard at a long distance. Where a single rock

stands alone, it is usually so much undermined that it resembles a low table with a single huge leg. There is a large perforation through the rocks at the southern extremity of Abaco, known as the "glass window," and also several submarine passages extending from one side of the island to the other. The rain carves grotesque forms out of the soft stone. This is sometimes coarsely honeycombed, or bristles all over with pinnacles or miniature chimneys, which are sharp as knife-edges, and compel you to use much caution in walking.

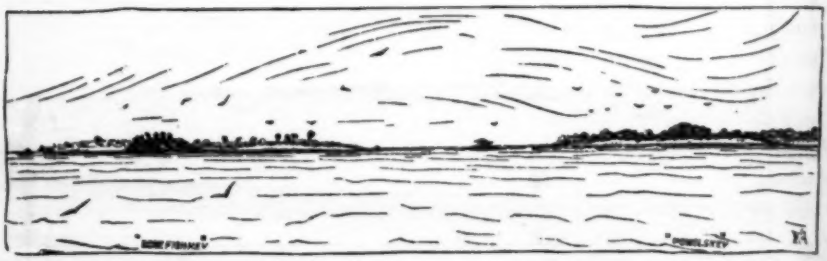


FIG. 3.—TWO CHARACTERISTIC CORAL KEYS AS SEEN FROM OFF THE NORTHEAST COAST OF ABACO. (The tallest trees are Cocoanut Palms. The eroded table-shaped rock between the islands is from a sketch made at another point.)

The dark-green foliage of the keys is frequently bordered by white, glistening lines, indicating beaches of coral-sand, which reflect the sun's rays with great power. Cocoanut palms find foothold along the shores, growing spontaneously from nuts cast up by the waves. In going northward from Green Turtle we pass successively Crab, Fiddle, Mun Jack, Ambergris, Spanish, Pensacola, Umbrella, Fish, Carter, Joe Keys, etc., and, in an opposite direction, Pelican Key, No Name Key, Great Guana Key, and numerous others.

The sharp contrast between the ordinary "white water" of the bay and the deep blue of the sea beyond the reefs, is very striking. The irregular black patches seen everywhere in the channel are due to algæ or similar plants growing on the bottom. The sea-floor between Abaco and the reefs is elsewhere covered with the white coral-sand which causes a marvelously brilliant color-effect in strong lights, the tints ranging from the richest emerald to a transparent greenish-white.

Numerous sea-fowl show themselves as we sail past their haunts: brown pelican, standing immovable like statues on the rocks, but suddenly expanding into birds of astonishing size; men-of-war or frigate birds, whose dark, cleanly-cut forms are strongly silhouetted against the sky; flocks of black-headed gulls, standing in military order, each facing the same way, on the rocks, rise and whirl off at our approach.

At Fish Key we found a large colony of the sooty terns (*Sterna fuliginosa*), or "egg-bird," as the natives call them, just beginning to breed. This is a collection of wild-looking rocks, rising ten or fifteen feet above the sea like a row of petrified sand-dunes, which in reality they probably are, and covered with low shrubbery, grasses, and vines.

When a long way off we noticed the birds hovering over the place, and on landing, their numbers increased until the air far above and around us fairly swarmed with the gliding forms of this graceful tern, and the strange medley of their harsh cries, together with the whirring of thousands of wings, was nearly deafening. They were nesting amid a tangle of shrubs three or four feet high, along a low, narrow ridge of one of the islands, a few yards from the water. Parting the bushes aside, we could see the old birds sitting on their eggs, and caught with our hands several which were snared in the vines as they attempted to fly. This tern resembles a large and powerful swallow. It has a sharply-forked tail, snow-white neck and breast, while the rest of the plumage is a dead black. They nest close together under the bushes, laying a single egg on the ground, without nest of any kind. Their eggs are easily distinguished from any others which we saw, being white or creamy and boldly spotted all over with umber and lilac. Even in these remote places the numbers of sea-birds are being yearly lessened by the natives, who persistently collect their eggs for food. The rare flamingo is now reduced to a colony of a few hundred on Abaco, where, as I was informed by an old settler, they numbered thousands several years ago, and similarly the beautiful tropic bird, which is hunted chiefly for food, is being gradually exterminated.

Close beside this key there was a small rock a few yards square, with scarcely a spear of grass upon it, which a party of the Wilson's tern (*Sterna hirundo*) held in undisputed possession. Their cone-tipped, olive-green, and spotted eggs lay in twos and threes on the bare surface of the limestone. Both this bird and the smaller edition of it, the least tern (*S. superciliaris*), which has similar habits, are called "shanks" by the islanders, while on the North Carolina coast (where we found both species breeding a month before) they are known to the fishermen as "great" and "little strikers." The Wilson's tern has a wide range, and is one of the most beautiful of a large and exceptionally striking family. It has a prominent black crest and coral-red bill and feet. Like many of our most attractive birds, it is shot down each season to satify the widespread demands of a barbarous fashion. Its pearly wings, or as often the whole bird, usually much distorted by the milliner, may be seen almost any day in the streets, pinned on to ladies' hats.

As we approached Paw-paw Key some tall bushes on the island appeared to be draped in deep mourning. Presently, as a large black company of birds rose one after another in the air, we recognized the frigate-bird (*Tachypetes aquilus*). I counted seventy of them as they soared above our heads. These swarthy giants cut a memorable figure against the sky, with their great angular wings, and long, forked tail. They mount slowly upward in spiral curves, with all the ease and grace of the hawk, until a safe height is reached, when they sail rapidly off to a distant island. The females are recognized by a con-

spicuous white spot on the breast. We witnessed the ascension and retreat of this pack from the same key on our return a few days later.

This little island is nearly bare except for the carpet of vines and low bushes. A few specimens of the *Conocarpus*, called here "button-tree," are growing along the water's edge. It is ten or fifteen feet high, and may be easily told at a glance by its silvery foliage. Its flowers are inconspicuous, in small globular heads, but they are quite fragrant. This and the *Rhacichallis rupestris*, called "seaweed" by our boatmen, are characteristic of all these islands. The latter is semi-prostrate, and has fine, spray-like foliage, resembling an evergreen. Its light-gray bark is noticeable and also its small saffron flowers. This shrub is very common on the exposed rocks just above high-tide mark, where various mollusks are found in great numbers. One univalve (*Tectarius*), nearly an inch long, is especially abundant. The rocks are peppered with them, and clumps of several hundred together are sometimes seen. It climbs up the stems of the Rhacichallis, on which it probably feeds, and seems to derive a double protection, from the colors of both the coral-rock and bark of this shrub, which it perfectly simulates.

Before landing at this key we had seen a large, black bird emerge from a mass of twigs in a bush overhanging the water, and, with its long neck outstretched, fly to an adjacent part of the island. This proved to be the Florida cormorant (*Phalacrocorax*) and its nest. I soon saw a number of these birds standing in line on a sand-spit with heads erect, like a squad of soldiers at drill. The nest was a shallow, rudely-built platform of twigs and grass, and contained three long,

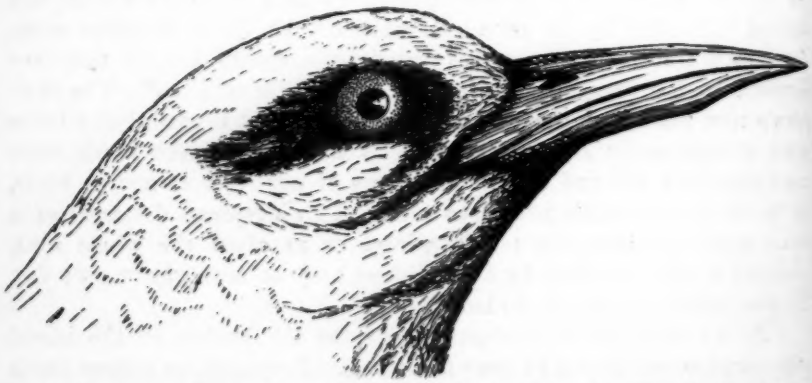


FIG. 4.—HEAD OF THE YELLOW-BILLED TROPIC BIRD (*Phaeton flavirostris*). (Three fourths natural size. From a sketch made by Mr. A. H. Jennings.)

bluish-white eggs, of a coarse, chalky texture. We found several nests on the island, most of which had been just completed. The long neck and thick stub of a body gives the cormorant a comical appearance, whether it is on the wing or walking erect on the beach. This species has sooty-black plumage, a yellow throat, and a blue rim round the

eye. The bill is long and cylindrical, the upper mandibles curving over the lower in the form of a sharp hook, and the lining of the mouth and gular-pouch is bright blue. The long, black quills of the frigate-bird were scattered over the island, and the bushes were whitened with their ordure.

I had not been many minutes on the key before I discovered a large snow-white bird nestling on the ground under a spray of Rhachichallis. Its wings were barred with jet-black ; its bill was bright yellow, and tapered to a spear-like point, which forbade too close familiarity. This proved to be the yellow-billed tropic-bird (*Phaeton flavirostris*), and we afterward caught several in our hands, taking them from the nest. When held up by the wings, they strike lustily with their bills and utter a peculiarly shrill cry. The tropic-bird lays a single egg on the ground beneath rocks or bushes. It is about the size and make of the hen's, and is finely sprinkled with reddish-brown, so as to appear of an almost uniform tint. One of these birds which my companion shot and slightly wounded, flew a short distance and then alighted on the water. As we sailed toward it, first one and then another bird came and hovered over it as if urging it to take flight, which it presently did, and with its attendants soon passed out of sight. These birds resemble the gulls in many points, but are distinguished from other sea-fowl by two long streamers in the tail, which wave behind them as they fly.

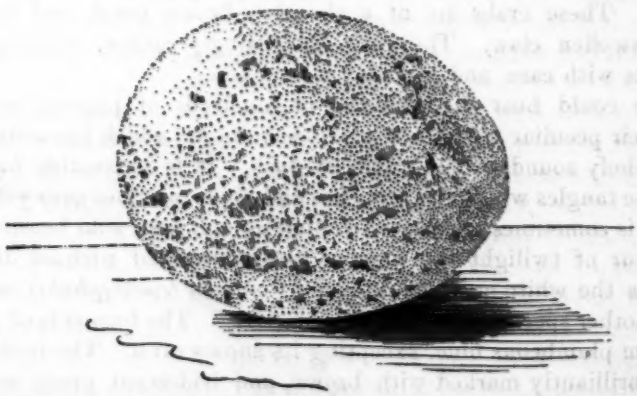


FIG. 5.—THE EGG OF THE YELLOW-BILLED TROPIC BIRD. (From Paw-Paw Key, natural size.)

Joe Key, forty miles northwest of Green Turtle, was the most interesting island we visited. Its windward side, facing the sea, is rocky and precipitous. A mangrove-swamp nearly divides it into two, and on the inside there is a smooth beach and a good harbor for small boats. It was nearly dark when we landed, but our attention was soon called to the great numbers of pigeons which were constantly flying to and fro from one point to another on the island. Before going ashore, we rowed to a narrow inlet between a detached cliff and the

main island, through which the tide flowed with a rapid current. Fish may be always found at such places, where they are apparently on the lookout for the food swept back and forth by the tides. Here our guides captured two fish in as many minutes, which were more than enough for our breakfast and supper. The largest of these was the grouper (*Epinephelus morio*) a thick, powerful fish of a dull, reddish-olive color, with a square tail like a cod. The other, the barracouta or sennet (*Sphyræna picuda*) has the shape of a pike. Its jaws are armed with long, projecting teeth. Neither of these fish are especially esteemed, but of the two the barracouta is the best. The inhabitants of these islands capture most of their fish and the turtle with the "grains" or spear. A water-glass also is usually carried in the boat. The grains is an awkward weapon, but in skillful hands a most effectual one, consisting simply of a spear-head attached to a rope, at the end of a long pole.

Above the sand-beach there were two small springs, where our guides scooped up enough water to fill a small keg. These were merely holes dug in the sand scarcely above high tide, and contained decidedly brackish rain-water, which, however, could be rendered palatable by boiling and by the addition of lime-juice. The swamp was bordered by an almost impenetrable growth of shrubbery and small trees, in which were hundreds of old pigeons' nests. The ground was literally strewed, particularly under the trees, with an interesting species of hermit-crab, which inhabits the empty shells of a common whelk. These crabs are of a chocolate-brown color, and have one large swollen claw. They are exceeedingly active, climbing steep surfaces with ease, and probably ascend trees.

We could hear the whirring of hundreds of pigeons overhead, and their peculiar cooing, *cu-oo-cu-oo-cu-hu-hu*, which has a singularly melancholy sound in the woods at dusk. It is impossible to see out of these tangles where the branches and vines interlace over your head, and it is sometimes necessary to climb up and take your bearings. At the hour of twilight the pigeons are approached without difficulty. Besides the white-crowned pigeon (*Columba leucocephala*) there was also another species, called the "rock dove." The former is of a nearly uniform plumbeous blue, excepting its snowy crest. The rock-dove is more brilliantly marked with brown, and iridescent green and blue. It is a pretty sight to see hundreds of these birds sitting erect on the trees, and to watch their rapid, incessant flight. If one is disturbed, all within gunshot take wing, and circle rapidly over the trees, sometimes encompassing the island before settling again. These birds were apparently about to breed here very soon.

There was a palmetto-grove on this island, in which a recent fire had burned away all the undershrubbery, leaving a clean floor to walk upon, and the charred trunks and new foliage of some of the palms showed how closely they also had escaped. These trees have great

size of trunk compared with their height, which gives them a decidedly dwarfed appearance. Some swollen boles, a foot or so in diameter, are only four or five feet tall. A pendulous spray of fine creamy flowers hangs down from the base of the leaves. This is succeeded by a small nut or berry, dried specimens of which were still on the trees. Many of the trunks were tattooed by a woodpecker, which also breeds on the island, as shown by its old nesting-holes.

The mosquito, which abounds everywhere along the keys, did not trouble us here, but the pest of the place was a microscopic midge, called the "sand-fly," with black head and transparent body, whose burning touch was like that of a sharp needle on the skin.

The Bahaman red-winged starling, looking much like our northern species (*Agelaeus phœniceus*), of which it is a variation, was common, and probably breeding on this key. It delivered its flute-like *warblee-ee* as assiduously from the top of a palm as its relative does his from the button-bush or alder of a New England meadow.

The black-headed or laughing gull (*Larus atricilla*) was nesting here also, as well as at most points where we touched. It is a common resident all along the South Atlantic sea-board. We found its nests and eggs at Portsmouth, on the North Carolina coast, the last week in May. It is easily distinguished by its black hood, which completely covers the head, ending abruptly on the neck. This cap is, however, exchanged for a white one in winter. These birds dwell in small colonies on the rocky keys, nesting a few feet above high-water mark. The nest is indifferently made of grass and seaweed, varying much in the amount of materials used, and contains from two to three large, olive eggs, mottled or spotted with darker pigment.

A handsome spike-grass (*Uniola paniculata*), whose wavy plumes are sometimes six feet tall, grows above the sandy beach. This same species occurs along the coast from Virginia to the Gulf of Mexico, where it is called "sea-oats." The green blades of the "West Indian lily" (*Pancratium Carolinianum*), a member of the Amaryllis family, are found growing in large clumps at the water's edge. Its flowers, which were now nearly past, are pure white, and remarkably fragrant. We found here also the *Sabbatia gracilis* in the sand, and a small leguminous tree, with clusters of reddish flowers, at which I saw the Bahaman honey-creeper—a delicate little warbler—busily at work.

The Cuban nighthawk (*Chordeiles minor*) was breeding here, as at several other islands which we examined. It is called "pilepedick," from its peculiar note, which is well reproduced in the name. It has many of the characteristics of the bull-bat of the Eastern United States, tumbling along the ground as if its wings and legs were broken, if surprised on its nest, and producing that peculiar booming sound when on the wing by sweeping down from a great height in the air. The young, which we found as frequently as the eggs, resemble a pinch of gray down, and so perfectly do both they and the eggs match the

gray rock on which they are laid, it is only by a rare chance if you find a nest without flushing the old bird. The young nighthawk is about as broad as long, and, unlike the callow young of most birds, it is covered from head to foot with a thick coat of down.

On our return we anchored the first night in a little harbor at Allons' Key, where two small fishing-boats had already taken refuge from a threatening squall. We saw the ruins of several huts on this island, and the remains of a small grove of cocoanut trees, which had been blown down in the destructive hurricane of September, 1884. The place was so infested by mosquitoes that this little settlement had to be abandoned. It rained heavily in the night, but our men took an early start, and awoke us the next morning at five by announcing the discovery of a

FIG. 6.—FRUIT AND FLOWERS OF THE SEVEN-YEAR APPLE (*Genipa clusiifolia*). (One half natural size.)

"loggerhead's track." The beaches had been leveled by the rain, so that any new impression could be readily seen. The turtle had ascended the beach to a point above high tide, had stirred up the sand, leaving a great heap over her eggs, and returned to the water but a short time before we landed. This was shown by the ebbing tide, which had retreated only a short distance from her last tracks. The eggs were laid in a bunch, and covered with sand a foot and a half deep. There were

just one hundred and thirty-nine of them. They resemble a white rubber ball, an inch and a half in diameter. The sea-turtle's eggs have a peculiar flavor, but are very palatable. The glair becomes tough and leathery by boiling, and is always thrown away. The breeding-season of the loggerhead (*Chelonia caretta*) lasts from May well into August, according to the statement of our guide, who also said that they deposited eggs several times in this period, producing as many as one hundred and eighty at the first laying, and perhaps no more than two or three at the last. The natives make a business-like search for these eggs each year, and sometimes surprise the female turtle on the beach. When she has once begun the egg-laying process, it has to be finished, even if she is turned on her back and made a prisoner immediately after. The extraordinary egg-producing power of these animals is all that preserves them from immediate extinction.*

FIG. 7.—THE WILD SAPODILLA (*Sapota achras*). (Three fourths natural size, showing some of the old fruit and the new flowers and leaves.)

Large forest-trees, such as pine, cedar, and mastic, which grow on Abaco, do not occur on the keys. We find here, however, smaller trees and shrubs in great variety. Besides those already mentioned,

* Some time ago a large grouper was speared by a fisherman off Sand Key near Nassau, and twenty-two young loggerheads were found in its stomach. This fish was doubtless feeding along the shore, and had evidently snapped up the young turtles just

there are three palmettos, called the "silver" and "thatch-top palms," and "hog-cabbage"; "sea-grape" (*Coccoloba uvifera*); the "seven-year apple" (*Genipa clusiifolia*); *Malvaviscus arboreus*, a handsome shrub, with red flowers, resembling a small hollyhock; mangrove (*Rhizophora mangle*); wild sapodilla (*Sapota achras*); and many others equally characteristic. Land-snails are very common on some of the islands, and the omnipresent lizards (*Annolis*) were the only reptiles which we met with.

The Genipa or seven-year apple is very abundant along the shores of the islands just above high-tide mark. It sends up from the ground slender brittle stems a few feet high, bearing creamy-white flowers and a hard, yellowish-green fruit, which is inedible. The leaves are dark green and highly polished.

The wild sapodilla is equally common, and attains the height of a small tree. The axillary flower-clusters appear a little in advance of the leaves, which in June add a touch of the brightest spring green to every thicket. The fruit, which is not edible, is covered with a rusty-brown skin, and is usually terminated by the long persistent style. The cultivated sapodilla forms a good-sized tree, and appears to grow spontaneously wherever it has been introduced. It differs from the former chiefly in point of size and in the superiority of its fruit. Possibly the wild form is the parent stock from which the other, with its sweet, pulpy fruit, has been derived; but I have been unable to gather any facts relating to this point. A milky juice flows freely from the wounded bark of the sapodilla-trees, forming a viscid gum, which the negroes use as bird-lime. It is also noteworthy that the *Isonandra gutta*, a Malayan tree, from the juice of which the gutta-percha of commerce is obtained, is also a member of the *Sapotaceæ* or Sapodilla family.

These islands have been largely colonized from the South, principally perhaps from Cuba; and the Gulf Stream and other agents, which have brought the plant-germs thither, have carried them also to the keys and coast of Florida, where they may have first become established. The seed-eating birds, finches and starlings, which are common on Abaco and many of the small islands, serve also as important distributors of grains and seeds of other plants. The great number of shrubs bearing edible berries may be partially accounted for in this way. The annual hurricanes, on the other hand, are certainly powerful agencies in scattering seeds over wide areas. Knowing the frequency of their occurrence and their long duration, we can see how by this means alone an island would soon acquire a rich and varied flora.

as they were making their *début* in the water. Thus it seems that these animals have to contend with enemies which are even more formidable than man, and it not surprising that this valuable and once staple product of these islands is fast becoming a luxury.

THE PSYCHOLOGY OF JOKING.

By J. HUGHLINGS JACKSON, M.D., F.R.S.

PUNNING, I think, does not receive enough attention. In spite of Dr. Johnson's well-known dictum, we should not despise punning. Sydney Smith says that it is the foundation of all wit. Supposing three degrees of evolution, I submit that punning is the least evolved system of joking, that wit is evolved out of punning, and that humor is evolved out of wit. Everybody has heard of Sydney Smith's remark —that it requires a surgical operation to get a joke into the head of a Scotchman. But he spoke without distinguishing. The Scotch have a great appreciation of those highly-evolved jocosities displaying the humorous, although, no doubt, a scorn of simple, lowly-evolved jocosities, such as plays on words. It is difficult to form a conception of a Scotch punster. Yet I have heard an Aberdonian, a physician of world-wide reputation, make a pun.

Punning is well worthy of the psychologist's attention. I seriously mean that the analysis of puns is a simple way of beginning the methodical analysis of the process of normal and abnormal mentation. This, I think, I can easily show. Vision is stereoscopic: in a sense it is slightly diplopic, for there are two dissimilar images, although there seems to be but one external object, as we call it. To borrow the ophthalmological term, we can say that mentation is "stereoscopic"; always subject-object, although we often speak of it as single ("states of consciousness," etc.). Just as there is visual diplopia, so there is "mental diplopia," or, as it is commonly called, "double consciousness." Now I come back to punning. We all have "mental diplopia" when hearing the answer to a riddle which depends on a pun—"When is a little girl not a little girl?" Answer: "When she is a little horse (hoarse)." The feeble amusement we have in the slightly morbid mental state thus induced is from the incongruous elements of a "mental diplopia." The word "hoarse" rouses in us the idea of a little girl who has taken cold, and the same-sounding word "horse" rouses in us the idea of a well-known quadruped at the same time. We have the sensation of complete resemblance with the sense of vast difference. Here is, I submit, a caricature of the normal process of all mentation. The process of all thought is "stereoscopic" or "diplopic," being the tracing of relations of likeness and unlikeness.

To call punning a slightly morbid mental state may be taken as a small joke, but I do not think it very extravagant to describe it so; it certainly is not if it be a caricature of normal mentation. A miser has been defined as an amateur pauper; the habitual drunkard is certainly an amateur lunatic; and in the same style of speaking we may say that—well, we will say that punning is playing at being foolish; it is

only morbid in that slender sense. The word "play" carries us forward in a slightly different direction. Jocosities of all degrees of evolution—(1) puns, (2) witticisms, and (3) humorous statements—are the "play of mind"; play in the sense in which the word has been used in the remark that the "æsthetic sentiments originate from the play impulse." A further definition of play as thus used is given in the following quotation from Spencer: "The activities we call play are united with æsthetic activities by the trait that neither subserve, in any direct way, the processes conducive to life."* There would be a great intellectual advance—due, I presume, to internal evolution—when man began to value things for their beauty apart from their use, one sign of his having "got above" his mere animal self. For it showed that, over and above mind required for mere animal existence, he had some surplus mind for greater ends of life. So I contend that our race owes some respect to the first punster. For the dawn of a sense of the merely ridiculous, as in punning and the simplest jokes, shows the same thing as the dawn of æsthetic feeling—surplus mind, something over and above that required for getting food and for mere animal indulgence. All the more so if punning be that out of which wit and humor are evolved. It is not a good sign if a man be deficient in humor, unless he have compensation, as Wordsworth had, in a sense of the sublime, or in great artistic feeling, or in metaphysical subtlety. The man who has no sense of humor, who takes things to be literally as distinct as they superficially appear, does not see fundamental similarities in the midst of great superficial differences, overlooks the transitions between great contrasts. I do not mean *because* he has no sense of humor, but because he has not the surplus intellect which sense of humor implies. Humor, being the "play" of mind, is tracing deep, fanciful resemblances in things known to be very different. This is "playing" at generalization, and is only a caricature of the same kind of process which made Goethe declare that a skull is a modified part of a vertebral column.

Now I am about—not really digressing from what I have just said—to say something which sounds very paradoxical: that persons who are deficient in appreciation of jocosities in their degrees of evolution, are in corresponding degrees deficiently realistic in their scientific conceptions. One would infer this *a priori*. Every child knows that a man born blind has no idea of light; but the educated adult knows, too, that the congenitally blind have no notion of darkness. And I think that observation confirms what *a priori* seems likely—that *pari passu* with the evolution of the sentiment of jocosity (playing at unreality) is the evolution of power of realistic scientific conception—from sense of the merely ridiculous with parallel realistic conception of simple things, up to sense of humor with parallel realistic conception of complex things. But we must be on our guard not to take

* "Principles of Psychology," vol. ii, p. 627.

commonplace realism about simple things to be realism when applied to very complex things. It seems at first glance more realistic to suppose that sourness is inherent in vinegar than that it is always a sensation in some percipient. But that the former hypothesis is very unrealistic is easily seen when we put such crude metaphysics in other words; the doctrine then is that part of the taster's own mind is outside himself. It is possible for the same person to be truly realistic in simple things, and to be intensely unrealistic in complex things. Thus, the really practical man, who may tell us that he despises metaphysics, may be crudely metaphysical when he deals with complex things—"explaining," for example, that a man comatose does not move because he has lost consciousness. Surely the truly realistic conception is that the comatose patient does not move any of his limbs from some physical disability—for essentially the same reason that a hemiplegic man does not move his arm and leg.

I now go back to my small joke that punning is a slightly morbid mental state, a "mental diplopia," a caricature of the normal "diplopia" of healthy mentation. From this point I make the assertion that the "physiological insanity" of dreaming is diplopic—a caricature of that of waking mentation. A physician reads in the day of the strained relations of European states; in his dream at night he is called in consultation by Bismarck, and advises a course of the iodide of potassium (directions for the application of the remedy were not given). Clearly, there are here two very dissimilar mental states "pretending" to be stereoscopic; manifestly a seeming fusion of ideas of prescribing for a patient with ideas of the attitude of European states. I hope some time to be able to show that such diplopia has the same kind of mechanism as that of the pun—that the two elaborate dissimilar states are held together by two same, or similar, simple mental states. I go on to remark that in some people there are beliefs as incongruously diplopic as some states in dreams—diplopic in that way to other people, at any rate:—(1). Killing a rabid dog to prevent people already bitten by it going mad. (2). Imagining it to be possible to study what are called "diseases of the mind" methodically without distinguishing between the physical and the psychical. (3). A cleanly mother, from maternal solicitude, refraining from washing the top of her baby's head, lest it should come to have "water on the brain." (4). Imagining it to be possible to investigate complex subjects without the use of hypotheses; for instance, that Harvey could have made observations and experiments to *prove* the circulation of the blood without *supposing* beforehand that it did circulate. (5). Anointing a blade with healing salve to cure a wound inflicted by the blade.

Once more I go back to punning for a new start, trying to show again by very simple cases that punning is only a caricature of, and therefore for the psychologist a valuable experiment on, the process of normal mentation. I take first a case which is almost if not quite a

pun, but one made unwittingly. What is called the inelegance of using the same word in one sentence, or in two consecutive sentences, causes mental diplopia. For even if each of the two words has the same dictionary meaning, we must bear in mind that a word loses something of that kind of meaning when forming part of a proposition, losing and taking meaning by and from its context. Hence the second time the word comes there is a faint revival of the ideas it symbolized when used the first time, along with a vivid revival of other ideas it now symbolizes; there is trivial confusion from slight mental diplopia, like that from an ill-understood pun. I now give a more striking example—one in which there is manifest diplopia without confusion.

A smell, say of roses, I now have makes me think of a room where I passed much of my time when a child. Here clearly is "mental diplopia," and the mechanism of it is quite similar to that of the pun, making allowance for caricature in the latter. For the true process is that the smell of roses, now having, develops what we call the same smell, but really another smell, that of roses once had, in the old room. The two scents, linked together, hold together two dissimilar mental states (1) present, now narrowed, surroundings, and (2) certain vague quasi-former surroundings. When the scent of hay, or the caw of rooks, rouses in us vague pleasurable feelings, the mechanism is of the same kind, but the process is more complex. To further insist on the fact that mentation is stereoscopic, with more or less manifest diplopia, I give an example of mentation which is exceedingly common. While writing I suddenly think of York Minster. Here is manifest mental diplopia (1) narrowed consciousness of my present surroundings, with (2) cropping-up of consciousness of some quasi-former surroundings. Of course something, whether I can mentally seize it or not, in my present surroundings, has developed a similar something associated with York surroundings.

Recapitulating, I can say that the process of all thought is double, in degrees from a stereoscopic unity of subject and object to manifest diplopia (two objective states for one subject). The process of all thought is tracing relations of resemblance and difference, from simplest perception—to say what a thing is, is to say what it is like and unlike—up to most complex abstract reasoning. The formula of the caricature of the normal process of thought is the "pretense" of some resemblance between things vastly different—from punning, where the pretended resemblances and real differences are of a simple order, up to humor, where both are highly compound. We have the "play" of mind in three degrees of evolution, three stages of increasingly complex incongruousnesses.

If I had time, I could, I think, show that this address on jokes is not itself merely one big poor joke, but that what has been said applies closely to the study of "mental symptoms" in serious diseases. I

should begin the new stage of the inquiry with the quasi-healthy feeling of "reminiscence," clearly an element in a mental diplopia. For my task would be an endeavor to show that all morbid mental states are departures from normal (stereoscopic) mental states in particular ways—that, for example, the process of mentation in the maniac is but a caricature of stereoscopic and diplopic mentation in healthy people. Thus, the reminiscence, although it is almost pedantic to call it morbid, is really a link between perfectly normal and decidedly abnormal mentation. For reminiscence occurs in slight attacks of a certain variety of epilepsy, as do other voluminous mental states ("intellectual auræ"): I call them all "dreamy states." These cases I should take next. There is clearly in them morbid mental diplopia, and yet this is traceably only a gross caricature of normal mental diplopia, being linked on to it by the reminiscence occurring in people we call healthy. And I think we may show that it has the same mechanism that puns have. Next, taking these miniature and transient cases of insanity, and other cases commonly called insanity, I should try to show that the comparison of mentation with vision is of direct value. In the symptomatology of a patient who has paralysis of an ocular muscle there are many elements. There is morbid visual diplopia; in insanity there is morbid mental diplopia. The ophthalmologist's "true" and "false" images have their analogues in the "true" and "false" mental states in the cases of epilepsy mentioned. In the former, when the divergence of the eyes is slight, there is more visual confusion; in the latter, when the dissolution of the highest centers is shallow, there is more mental confusion. In the former, when the divergence is great, diplopia ceases (the patient, the ophthalmologist says, "neglects" the false image); in cases of epilepsy, upon deeper dissolution than that with which there is the "dreamy state," the actions are considerably coherent. The "erroneous projections" of the former have their clear analogues in the hallucinations of many cases of insanity. Believing that all diseases are to be looked on as flaws in different parts of one evolutionary system, I urge the "Comparative Study of Diseases of the Nervous System." I submit that, recognizing the enormous difference between insanity and ocular paralysis, a profitable comparison and contrast may, nevertheless, be made, which will further a better knowledge of both. I do not mean simply that ocular paralysis may be taken as an illustration to simplify explanation of a case of insanity, but also that, both being examples of dissolution, the very same principles are displayed in each.—*Lancet.*

THE Bishop of Manchester preached recently that the criticisms of men of science had induced Christians to modify some of their old views derived from the Bible. A closer study of the book showed that there had been evolution in religion—a gradual and orderly development by which people were led to the truth as they could bear it.

RAILROADS AND TRADE-CENTERS.

By APPLETON MORGAN.

IF, a century or so from now, a student of the political history of the United States shall ask, How happened it that its Congress was once moved to establish a court of star-chamber aimed at an industry not ordinarily operated except by charter; a court which was to be not only an oyer and terminer, but an inquisitor of its own motion; which should dispense with due process of law or with any process at all; which should supply penalties, civil, criminal, and as for contempt with plentiful liberality; but never assume, nay, never so much as hint or suggest a probable or even possible protection or premium upon any probable or even possible good or useful thing to be by any accident done or subserved by that industry—if, we say, the political student should ask that question, in view of the fact that no public interest seemed to have required such a statute, and that its immediate effect was to raise freight rates to the people passing the law—the lawyer of that date might suggest possibly that an application of the rule of interpretation, which provides that the intention of the framers of a statute may be looked into (under certain restrictions), would be most likely to furnish some sort of a clew.

Should the inquirer then cast about for this intention, he might perhaps light upon the following (which I clip from a morning paper):

"*Springfield, Ill., June* 30.—At a meeting of the Illinois Grain Merchants' Association yesterday, Senator Cullom was called upon to speak on the Interstate Commerce law. He said: '. . . The requirements of the law that all charges shall be reasonable, and that there shall be no unjust discrimination or unreasonable advantage or preference in favor of any person or place, had been shown by the character of the complaints against the enforcement of the act to be absolutely demanded.' In reference to the long and short haul clause, he said: '*For many years the railroads of the country have so absolutely controlled our interstate commerce that we have no means of knowing what are the natural channels of trade, or what would be the effect of the natural laws of trade upon many, at least, of the present commercial centers.* What the critics of the law call *natural centers of trade are centers created by railroad favoritism which has diverted trade from its natural channels into artificial ones at the expense of less favored localities.*'" [The italics here are ours.]

In reading the above, the student of political history aforesaid might be led to remark that to centralize and to submit to the espionage of a simple paternal commission of this Government, not only the entire railway interests of the United States (being its operation of 125,379 miles of railway, with a funded debt of $3,669,005,722, upon

which interest is to be earned), but the minutest daily detail of such operation, is a rather costly method of gratifying a single Senator's or even a whole Congress's laudable curiosity as to "what are the natural channels of traffic, or what would be the effect of the natural laws of trade upon many, at least, of the present commercial centers"; and that it appears to be a rather cool proposition to charge the cost of gratifying the aforesaid curiosity upon the only party who had betrayed no curiosity in the premises whatever, but kept on its even tenor, operating at its own cost the franchises the people had given it, and endeavoring to pay one and one third per cent on the capital it employed.

But, to drop the student of political history, it is important, it seems to me, for the present generation to know, at last, just why the Interstate Commerce law was passed, and for just what sins of the railways they have been put under pedagogical surveillance. *It is because these wicked railways have been creating trade-centers!* The revelation is a particularly startling one, because among the railways themselves the maxim had always been to try and accommodate themselves to such trade-centers of the country as already existed at any possible expense and at all hazard. No terror of injunctions out of chancery were too terrible; no right of way was too costly; no rivers too broad; no mountains too solid; but the railway must supermount and penetrate, at whatever expense, to reach the trade-center which Nature had already provided. This, I say, has always been the maxim of the railway company: "Do the business of your territory, count first cost of construction as absolutely nothing. A railway is a means of supply to a trade-center, or a connection between two or more trade-centers. The product of the country must have its best markets, but those best markets are at its trade-centers; at all odds we must get to them. No matter where the president of the company lives, or where the capital is subscribed. Construct our line to the best market!" Such, practically, have been the directors' and the promoters' instructions. And, indeed, it has always seemed to be supposed, even outside of the magic circle of the railway companies, that the capital to build railroads was subscribed on the understanding that they were to do the public business, and not operate against it and in its teeth, and that it would be unnecessary demonstration of corporate idiocy to attempt to procure capital upon any other. But now comes Senator Cullom with his proposition, and we are advised that we have all been wrong; that, instead, these naughty railways have been at work not connecting but CREATING trade-centers!

Had anybody but one of the fathers of the Interstate Commerce Commission made this statement, not much attention might have been paid to it. Every railroad man—certainly every shipper over a railway—knows that the establishment of a trade-center is a matter entirely out of the power and beyond the control of railway companies

not only, but of any known human power; a matter regulated by the unwritten laws of trade, laws not only unwritten but, except in their operation, entirely unknown; a result and not a process. Let Senator Cullom, for example, try and establish a trade-center, and he will speedily recognize the impossibility of it. And did Senator Cullom try, it would not be the first attempt. There are plenty of platted cities and towns to-day in the United States which have been laid out to make grass grow in the streets of actual cities in whose favor Nature and geography long ago decreed that they should be, in deed and in truth, trade-centers; and the platters, their successors and assigns, yet feel the hiatus made in their bank-accounts by payment for the costly honor of making valuable suggestions to the attraction of gravitation.

I need not, I suppose, refer, for example, to the plethora of "cities" and "city sites," whose prospects the vast dockage and trade territory of Chicago has superseded. But the force, the unwritten law, that has twice built the city of Chicago within the memory of men just entering middle age, was not devised by human brains. Perhaps a better answer to Senator Cullom's remarkable proposition about "trade-centers" could not be devised than a brief tracing of the operations of this law in this very building and rebuilding of a geographical trade-center of this continent. And if it shall be said "even if human laws did not build Chicago, a lack of exact knowledge of this operation and an interstate jealousy of their inevitable result contributed to the building," yet that ignorance and jealousy, it may be replied, were a part of the result of the working of the law, rather than of the process by which it worked.

No human foresight placed Lake Michigan where it is. But human foresight did perceive that somewhere near its foot a great commercial center must some day arise. Various points were selected by shrewd pioneers; and if the reader will take down his map he will find them still indicated upon it—Milwaukee, Racine, Kenosha, Waukegan, and Michigan City were perhaps the most promising of these (the latter especially, since here was the very foot of the great trunk or tongue of navigable water which penetrated from the north into the rich central ridge of the nation, along which its integral artery of inland communication must run, and from whose head great navigable wings were spreading east and west). Yet, while all these points were selected, somehow the swamp where Chicago now lies was carefully avoided. But it seems those natural causes which we call laws of trade were in operation; the heavy settlement of the Ohio Valley sought its outlet on the lakes, and somehow the first practical expression of that search—a railroad—capped, not Milwaukee, Racine, or Kenosha, but the swamp where rose Chicago. And now occurred a wonderful thing. The jealousy of those lake-ports, which the laws of trade had passed aside in favor of Chicago, began to operate. Each

of these lake-ports saw the increasing prosperity of Chicago, and each and every one of them fell into the very error which Senator Cullom cherishes to-day. In almost his exact language each one said to itself —You people who are rushing to Chicago to build your docks and elevators are poor deluded creatures, who "have no means of knowing what are the natural channels of traffic." Those railroads are fooling you. Don't go to Chicago. Here at Racine, at Kenosha, at Milwaukee, is the place for your capital. Here is where the great development is to be. (There was no Interstate Commerce law then, but here was its spirit, and its root was, as perhaps a generation later, jealousy pure and simple). But somehow the capital still poured into Chicago; its docks and elevators multiplied. What was the next step of the jilted towns? Each went to work; each for itself built a railroad of its own, mortgaging the property of its citizens, issuing its bonds, pledging its credit, and multiplying its taxes to pay for it. What was the result? Simply that the wheat and corn and produce which had come to each of these ports to be loaded into ships—thereby making the trade on which the town lived and fattened in moderate prosperity—now having a cheaper transit to a larger and therefore better market, went where?—went to Chicago! In other words, these cities had destroyed themselves—impoverished not only their citizens, but loaded their successors with debt—not to increase their own prosperity, but that of hated Chicago! They had tried to fight the inexorable laws of trade and of trade-centers, and had been ruined in the attempt. The West is not free to-day from the effects of this lake-side effort to guide and assist the natural laws of trade. Money is yet being paid annually into New York trust companies in the vicinity of Wall Street by these same small lake cities (many of which by the prevailing of better counsels have become manufacturing towns of wealth and importance), as their yet uncompleted penance for believing in their own wisdom as against the unwritten statutes of the universe; and if Senator Cullom sincerely believes that trade-centers can be created by human foresight, he can—by following up the map in the direction I have indicated—find many students in the hard school of experience willing to enlighten him.

It has been the bulk of criticism against the Interstate Commerce law, not that it was unconstitutional, but that it was an attempt to equalize by statute what Nature and cosmic forces has rendered unequal; that it was Geography and not the railways which had established sea-ports and lake-ports and river-ports; and that—since the sea, the lakes, and rivers did not as a rule charge more for a short than for a long haul—it was putting the statute-book of the United States into the position of a bull warning off comets, to give a railroad a franchise *to live* with one hand, and with the other to brandish a sword over it if—in operating its franchise—it compete with its competitors! But the bottom objection on the part of the people to the railway com-

panies which has produced the Interstate Commerce law, lies unconsciously far deeper than that. It lies in the fact that the laws of trade invariably select the same points for trade-centers that Nature herself has first selected. New York, Boston, Baltimore, New Orleans, San Francisco were trade-centers before railroads were devised. When a trade-center was wanted on Lake Michigan, Chicago was selected, not by men, but by the force of natural laws. What the capitalists called a "swamp," and so avoided, was really a business plain. Sand drifted in, and built a bar before Michigan City; at certain other lake points the bluff, crumbling constantly into the lake, imperiled the harbors; other natural causes worked away at others. The cosmic forces were at work in favor of Chicago, and Chicago was elected trade-center of the majestic West. In other words, it is simply because *it can not* dispense with the discriminations of Nature that the people are disappointed with the railway as an institution, and so propose to vent their disappointment by enacting laws bristling with penalties, but nowhere promising them protection; putting their affairs into the hands of non-experts, and calling them to penal and paternal account for every breath they draw. If Senator Cullom seriously believes that the railroads have created the trade-centers of this continent arbitrarily, let him tell us why every railroad company in the country is willing to spend millions of dollars in order to get into such cities as New York and Chicago? Could a railroad create a trade-center as easily as Senator Cullom imagines, it would certainly come cheaper to that company to make a trade-center of their own than to buy their way—against every known legal, commercial, political, and geographical obstacle—into one already established.

The Pennsylvania Railroad Company was built by Philadelphia capital; certainly it did not desire to discriminate against Philadelphia. If railroads can make trade-centers where they like why did not the Pennsylvania Railroad create a trade-center for itself in its own City of Brotherly Love? The Lehigh Valley Railroad Company is a loyal Pennsylvania corporation, and its owners are natives there and to the manor born. Why did not the Lehigh Valley Railroad Company make for itself trade-centers on its own line, where land was cheap, instead of crowding into New York City at one end and into Buffalo at the other, at enormous cost? The Grand Trunk Railway is a British institution built to foster the interests of Great Britain's greatest colony, at the direct expense of its greatest commercial rival in the world's family of nations—the United States; why does not the Grand Trunk road make for itself commercial centers at Montreal or Toronto or Hamilton or Ottawa or Windsor? Why has it spent millions of good honest British gold in buying its way into Chicago at one end and Boston at the other? If, the moment railways were organized, they set the laws of Nature and of man alike at defiance, and began "to divert trade from its natural channels into artificial

ones at the expense of less favored localities," as Senator Cullom boldly charges, why is the Baltimore and Ohio Railroad, owned in Baltimore, and largely by that city itself—a corporate pet of the State whose securities are a legal investment for trust funds—expending its earnings and surplus like water to parallel the Pennsylvania in a territory requiring massive construction, and fighting not only that corporation, but the State of New Jersey, in order to get into the city of New York at one end, as it has succeeded in getting into Chicago at the other? Why not save your millions, gentlemen managers of the Baltimore and Ohio Railroad Company, and build a few trade-centers for yourselves at small expense? Senator Cullom says it is simplicity itself to make an artificial trade-center; that railways have not only had no difficulty in doing it, but have actually and tortuously thereby diverted trade from natural trade-centers to the artificial ones created by themselves. Why not, then, scatter as many trade-centers as your business requires along the line of your railroad, and grow opulent beyond the dreams of avarice by doing business between them, with no possible competition to intrude and make you afraid? Seriously, is it not common information on the subject that the laws of trade are as inexorable as those of gravitation, and that it is simply impossible for human ingenuity to create a trade-center or to destroy one already made by Nature? Yea, and, moreover, that not only are human beings unable to shift the trade-center, but they can not even alter the local commercial centers of a trade-center. When Chicago was wiped out by conflagration it occurred at once to certain clever owners of real estate in the neighborhood of the heart of the city—within the city lines, and of easy communication therewith—that their opportunity had arisen. Instead of buying land in the old business centers at ten thousand dollars a foot, and spending a reasonable fortune in carting away *débris* before beginning to erect new walls let us go to work at once and build on our own lands, they said; the trade of this vast metropolis can not wait, it will come and transact itself on our premises as soon as completed. What was the fact? The clever ones built well and richly, and sat within and wooed the commerce of Chicago to change its seat. But they wooed in vain. The commerce of Chicago transacted itself knee-deep in its own ashes, and in tents and hemlock shanties, until it could re-rear its own palaces over its own head on the very spot where it had thrived before, and refused to hear the voice of the real-estate charmers, who disappeared in bankruptcy and disappointment as the result of trying even to move the sites of the local habitations in which the commerce of a city dwelt. And their successors have not yet forgotten the experiments of their principals. And so it is throughout the continent. The honest farmer in Vermont or in Central Illinois does not perhaps grumble because a few superficial feet of land on the East River, in New York City, or on the Chicago River, in Chicago, are worth more for trade pur-

poses than the aforesaid honest farmer's acres in his interior precincts. But he does complain, and, what is more, makes his complaint a political engine for passing Interstate Commerce and "Granger" laws, when he finds that his produce can not be marketed anywhere except upon these very few square feet, and that the railway will persist in charging him more money to haul his product from Vermont to New York, or from Central Illinois to Chicago, than it does to carry it to the heart of the great American desert, if he shipped it so. Is it not true that it must cost more to go where everybody wants to go, than to go where nobody wants to go? Is there, in other words, a mundane condition in which the laws of demand do not regulate the laws of supply; and, interchangeably, the laws of supply the laws of demand? Surely, it seems a kindergarten sort of business to even ask the question; and yet, honestly, is not this the very bottom of the non-railroad public's objection to railroads (their unconscious objection, no doubt, but still their objection and their grievance), viz.: that, after all these years of railroads, the business centers are just where they always were—New York, Boston, Chicago; that the railroads *have not* diverted the business of the continent from the trade-centers and planted them elsewhere, and so given other merchants than those of the first commercial center a chance to grow rich? Is it not, in other words, not *because they have*, but *because they have not* made arbitrary centers and "diverted trade from its natural channels," that they are put under the centralized dictatorship and power of an Interstate Commission? The Almighty set the bounds within which the Atlantic Ocean and Lake Michigan roll and fret. If Senator Cullom states facts when he says that railways built by human hands can divert trade from its natural channels and create by favoritism natural centers of trade, then it is unjust and monstrous that these railroads should still operate themselves on the Scriptural principle, "that to them that hath shall be given, while from them that hath not shall be taken away even that they hath"; and still wickedly cater to the Atlantic Ocean and Lake Michigan ports (which were there before the railways were built), instead of equalizing matters and making trade-centers for the interior where there are no Atlantic Oceans and Lakes Michigan. Why should the railroads cruelly carry trade to and from those ports which are already trade-centers by reason of their waterways? Let the railroad companies be just and fair. To be sure, railways in Europe still despotically carry to Liverpool, Antwerp, Marseilles, but this is a land of equal rights. Let all its citizens have equal privileges, and equal opportunities of getting rich. The New York merchant and the Chicago merchant have grown rich because they have the Atlantic Ocean and Lake Michigan over which to do business. Now let the railways (who have only, according to Senator Cullom, to turn their hands over to oblige us) build some trade-centers for the honest farmer, or the interior merchant. Let us have as many

trade-centers as we have watering-places, for example, until this nation, where the people make the laws and own themselves, becomes the land of trade-centers! And if the coarse and brutal railway company—owned by the grasping and bloated capitalist, the heartless Gould, or Vanderbilt, or Huntington, or Garrett—will not give us any trade-centers, let us petition the Interstate Commerce Commission, that these men and their soulless companies cease to dominate and despotize over this republic, and build us trade-centers wherever we want them; and, if they then refuse, let the Commission itself designate the points where our trade-centers shall hereafter erect themselves, and to which our railways shall build their track.

The simple, honest truth is that railways, like natural persons, must live by doing what is set before them; that however their tariffs are regulated, whether discriminations by rebates and drawbacks are allowed or disallowed, whether they are ordered to charge more for the long haul or the short, whether passes are given to shippers or refused—the railway must do the business the people bring to it, or go into bankruptcy and wind up. If grain seeks Chicago, if beef seeks New York, if cotton seeks New Orleans—to Chicago, New York, and New Orleans must the railway haul these products. It can not carry them to Milwaukee, to Albany, to Mobile. And, moreover, to pay its fixed charges, the railway company, like any natural person, must take the business it pays it to do, and reject that which will not pay it. Neither a railway company, nor all the railways on this continent, nor yet the Interstate Commerce Commission, nor any merely human agency, can make a trade-center. It is a disappointment, no doubt, that this is so; that toward points already favored with ample water communication, and to those only, will railroads extend their tracks, and ultimate their systems. But, even though that disappointment be crystallized in penal and prohibitory legislation, such indeed has always been the vital principle of self-preservation in the railway, as in the human system: and such, indeed, I fear (especially since Judge Deady has held judicially that railways have a right to live), will always be the rule, whether or no this people's antidote for their disappointment be to place the railroads in charge of changing Administrations at Washington, or whether tariffs will be more reasonable when left to politicians than to railway experts.

An English writer maintains that international arbitration must take the place of war, because war costs so much more than it used to do. The expense of war in the middle ages was limited to the men it killed, the property it actually destroyed, and the value of the industrial occupations the soldiers were withdrawn from. Now the burden of even a local war of relative insignificance is felt in every quarter of the world; and important business enterprises at the antipodes may be ruined by conflicts which in the old days would hardly have been heard of outside of their immediate scenes.

RACE AND LANGUAGE.*

By HORATIO HALE.

ETHNOLOGY has been defined, briefly, as "the science of the races of men," and, more fully, as "the science which treats of man as a member of a tribe or nation, and of his culture, morals, and language." Many treatises on this science have been given to the world by scholars of the first eminence, from the days of Camper and Blumenbach to our own time. But, when we examine their works, we are struck by the fact that no two of them are agreed on the mere elements or fundamentals of the science. If we inquire, for example, the number of the races of men, we find that Virey is satisfied with two, and Cuvier with three—that Linnæus makes four, Blumenbach five, Buffon six, Peschel seven, Agassiz eight, Pickering eleven, Friedrich Müller twelve, Bory de St. Vincent fifteen—while Morton increases the number to twenty-two, Crawford to sixty, and Burke to sixty-three. If we seek the criteria by which the races are distinguished, we discover that one high authority proposes the color of the skin, another the texture of the hair, another the shape of the skull, and a fourth mere geographical location—while others combine with one or more of these distinctions the minor characteristics (as they deem them) of language, stature, and mental traits. On the most important question of all, the question whether the races of men are distinct species or simply varieties, the votaries of the science are divided into opposing camps. In the latest works of the most distinguished anthropologists, we find the views of the monogenists and the polygenists as far apart and as decided as they were fifty years ago.

The question naturally arises whether a study which has no established principles and no accepted classification can rightly be dignified with the name of a science. Writers whose opinion on such a question must be received with respect have been inclined to answer it in the negative. Eminent among these, from the position which he holds, must be ranked the distinguished chief of the American Bureau of Ethnology. "There is," declares Major Powell, in a late number of "Science" (June 24, 1887), "a science of anthropology, composed of subsidiary sciences," which he enumerates. "There is," he continues, "a science of sociology, which includes all the institutions of mankind; there is a science of philology, which includes the languages of mankind; and there is a science of philosophy, which includes the opinions

* This paper (under the title of "The True Basis of Ethnology") was read, in part, before the Section of Anthropology, at the last meeting of the American Association for the Advancement of Science, when it called forth an interesting discussion. It is now presented in a fuller form, with additional evidence and arguments, which may answer some of the questions then raised.

of mankind ; but there is no science of ethnology, for the attempt to classify mankind in groups has failed on every hand."

No one who reviews the latest works on this subject can deny that the opinion which Major Powell thus expresses, with a conscientious frankness that does him honor, is fully justified by their contents. And it should be added that he has not been the only one, or the first, to express this opinion. Among those who have written on this subject, no one has achieved a higher reputation than Oscar Peschel, whose too early death deprived the world of a master in this branch of study. In his well-known work on "The Races of Men and their Geographical Distribution"—a work unsurpassed for wide research and acute insight—he passes in review all the physical traits which have been proposed as means of race-distinction, and finds them all insufficient. He concludes his chapter on the subject in terms as decided as those of Major Powell. "In summing up," he says, "we must needs confess that neither the shape of the skull nor any other portion of the skeleton has afforded distinguishing marks of the human races ; that the color of the skin likewise displays only various gradations of darkness ; and that the hair alone comes to the aid of our systematic attempts, and even this not always, and never with sufficient decisiveness. Who, then," he adds, "can presume to talk of the immutability of racial types? To base a classification of the human race on the character of the hair only, as Haeckel has done, was a hazardous venture, *and could but end as all other artificial systems have ended.*"

If all artificial systems of classifying human races have ended in failure, shall we renounce all attempts at such classification, and affirm that there is no such science as ethnology? Or shall we endeavor to discover some natural method by which the numerous varieties that we all recognize in the populations of the globe can be clearly and positively distinguished and classified? We have a notable example set before us in the history of another science, which from a crude and hopeless chaos—made by centuries of the acutest study and observation only more confused, irrational, and perplexing—was suddenly, by a single discovery, transformed into one of the clearest, most regular, and most fruitful of sciences. When Aristotle pronounced that all substances were derived from four elements, fire, air, earth, and water, the science of chemistry may be said to have been as far advanced as was that of ethnology when Linnæus made his four divisions of humankind into the white European, the brown Asiatic, the red American, and the black African. Nearly twenty-two centuries passed from the time of Aristotle before Lavoisier, Berthollet, Gay-Lussac, and, above all, Dalton, discerned the true physical elements and their modes of combination, and thus made chemistry a science.

Many scholars have sought to find in language the basis of a natural classification of the races of men. Their attempts have thus far

been frustrated by various causes. One of these has been the ignorance which has until lately prevailed in regard to the number and true character of the existing linguistic stocks. It is not very long since most philologists seemed unable to extend their views beyond the Aryan, Semitic, and Chinese families of speech. All other idioms were looked upon as little better than formless gabbles, unworthy of serious study. Duponceau, the father of American philology, was the first to bring to the notice of scholars the important fact that among the languages of America there are some which in happiness of construction and in power of expression deserve to rank as high as the Indo-European tongues, and far higher than the Chinese or even the best of the Semitic languages. His assertions, though confirmed by abundant evidence, were long in overcoming the earlier prejudices. But they are now accepted by the highest authorities. More than fifty years after the date of Duponceau's first treatise, Professor Max Müller expressed his surprise that "this most tempting and promising field of philological research has been allowed to lie almost fallow in America—as if these languages could not tell us quite as much of the growth of the human mind as Chinese or Hebrew or Sanscrit." And to emphasize his meaning he adds: "To my mind the structure of such a language as the Mohawk is quite sufficient evidence that those who worked out such a work of art were powerful reasoners and accurate classifiers." * Not less decided is the opinion expressed by Professor Whitney, in his "Life and Growth of Language," concerning the Algonkin speech. "There are," he writes, "infinite possibilities of expressiveness in such a structure; and it would only need that some native-American Greek race should arise, to fill it full of thought and fancy, and to put it to the uses of a noble literature, and it would be rightly admired as rich and flexible, perhaps, beyond anything else that the world knew." Nor is it only in America that languages of this superior quality are found. Dr. R. N. Cust, in his work on the "Modern Languages of Africa," has given us the opinions expressed by the able French and English and American missionaries and grammarians who have written on the remarkable Mpongwe language, spoken on the western coast of that continent, near the equator. They speak, with one accord, of its "beauty and capability," its "elaborate structure and musical tone," its "regularity, exactness, and precision," its "order and philosophical arrangement," and especially its "wonderful capacity for conveying new ideas," making it needless for the missionaries to borrow foreign words in their biblical translations.

It is true that the objectors, though partially silenced by such authorities, are not altogether convinced. There is still an objection occasionally urged, founded not on fact but on an error in reasoning.

* From a letter of Professor Max Müller to the writer, quoted in "The Iroquois Book of Rites" (1883), vol. ii of Brinton's "Library of Aboriginal American Literature."

The Iroquois, Algonkins, and Mpongwes, we are reminded, are barbarous peoples, and can only have barbarous languages; which is about as philosophical as it would be to affirm that barbarous tribes must necessarily have barbarous complexions, barbarous hair, and barbarous lungs. Careful comparison of all the known facts will show that the structure and capabilities of a language depend entirely on the natural capacity of the people with whom it originated, and not at all upon their degree of culture. Are we to forget that our own Teutonic and Celtic ancestors were barbarians?

Another difficulty, and perhaps the greatest which has stood in the way of the linguistic classification, has been that which has arisen from the mixture of races. The negroes of the Southern States and of the West Indies speak not African, but Indo-European languages. Berbers in North Africa speak Arabic. Iberians in Spain speak a Latin tongue. Black and woolly-haired tribes in Melanesia speak Malaisian dialects. Throughout the globe these transfusions and comminglings of language and race have been going on for ages. How, then, can we employ as a means of distinction an element, like the linguistic, which is continually varying?

The answer to this objection is plain and conclusive. It is precisely the same answer that a chemist (to revert to our former comparison) would give to a similar objection. "How can your pretended elements," he might be asked, "be made the foundation of a science, when they are constantly occurring in new combinations and strange forms, where they can not be recognized? Your oxygen and hydrogen gases, put together, become a liquid in which no quality of either can be traced. Your carbon is at one time a diamond, and at another time a coal. Do you really mean to offer these constantly-varying substances as the first elements and bases of a science?" "Certainly I do," he would reply; "and it is in these very combinations and changes of form that a careful analysis has found the clearest evidences and the true value of our science."

Such is exactly the answer of the ethnologist. Analyze carefully the dialects, nominally English, French, or Spanish, which are spoken by the negro populations of America, and we find in them the best possible evidence of the origin of the people who speak them. We find the European words presented in a corrupt state, broken, distorted, often hardly recognizable, the pronunciation strange, the grammar peculiar. Looking still more carefully, we find many words of African origin scattered through the speech. If history were silent, these facts alone would satisfy us that there is here a combination of languages, of which we could detect the various origins. A further experience would show us that in every such case, where a mixture of language exists, there has been invariably a mixture of blood. Whenever a negro or Indian community speaks a dialect which is mainly English or French or Spanish, we may be certain that there is in that com-

munity a considerable infusion of English or French or Spanish blood. And though, in such a mingling, the blood of one race and the language of another may preponderate, yet even this fact is not perplexing. Apart from history, the speech alone, rightly studied, will indicate with sufficient clearness the origin and the circumstances of the mixture.*

A striking and indeed crucial test of the decisive value of language in ethnological classification is found in the case of Madagascar. In seeking the origin of its inhabitants we should naturally turn first to Africa; and there, in fact, we find, among the Nubians and the Hamitic tribes of the eastern coast, people bearing sufficient resemblance in shape, features, complexion, and hair, to the natives of Madagascar, to warrant the opinion of their relationship, in the absence of any stronger evidence to the contrary. Remembering, however, that the Arabians in early times had much intercourse with the great African island, we turn to their country and find in the tribes of Yemen a similar resemblance. We then, perhaps, consider how readily the swarthy and curly-haired Dravidians of Southern Hindostan might have found their way to Madagascar, with the help of the northeast monsoon. To decide from which of these probable sources the ancestors of the Madagascar natives were derived, we have recourse to their language; and we ascertain, beyond the shadow of a doubt, that they were neither Africans nor Arabians nor Dravidians, but Malays. To reach their new abode they had to cross the entire width of the Indian Ocean, a distance of three thousand miles. This origin is a fact which no ethnologist now thinks of questioning; and the only decisive evidence to establish it is the language of the islanders. It is true, that when we have ascertained this fact by the linguistic evidence, we find ample material in the character and customs of the people to confirm it; but without the positive test of language this subsidiary evidence would be altogether insufficient as proof of such derivation. No one who considers the case of Madagascar can reasonably doubt that in language, and language only, resides the true distinction of races.

From the great number and the marked peculiarities of the linguistic stocks of this continent, America may be considered to offer by far the best field for the study of scientific ethnology. This fact was early apparent to that remarkable group of philologists, among whom

* Against this comparison of the linguistic stocks with the chemical elements (which is offered, of course, merely as an illustration, and not as an exact parallel), it may be objected that, according to the latest theory, these elements are all merely allotropic forms of a single substance. But, in fact, if the truth of this theory should be established, it will only serve to make the force of the illustration still more striking. In a "vice-presidential address," on the "Origin of Languages," delivered before the section of Anthropology in the American Association for the Advancement of Science (and published in the "Proceedings" of the Association for 1886), I endeavored to show in what manner all the linguistic stocks have probably originated from a single primitive language. Both theories, it may be added, simply exemplify the tendency of science to trace back all varieties to unity.

Duponceau, Gallatin, and Pickering were the most conspicuous, who fifty years ago laid the foundation of American ethnology, basing it entirely on language. Albert Gallatin, applying to the study of linguistics the penetrating sagacity which had resolved the most intricate questions of national diplomacy and finance, framed on this basis his great work, the "Synopsis of the Indian Tribes east of the Rocky Mountains," which, published in 1836, still remains the highest authority on the subject. Later investigators have followed in the same line. Hayden, in his "Ethnography and Philology of the Indian Tribes of the Missouri Valley"; Dall, in his treatises on the "Tribes of Alaska and of Washington Territory"; Powers, in his "Tribes of California"; Stoll, in his "Ethnography of Guatemala"; and Gatschet, in his account of the "Southern Families of Indians," have all been inevitably led to the linguistic classification as the only scientific method. The greatest of living historians has given to this method the weight of his authority. The latest revision of Bancroft's "History of the United States" (1887) comprises a succinct but minutely accurate enumeration of the Indian tribes east of the Mississippi. He finds that there is "no method of grouping them into families but by their languages"; and he has accordingly named and classed the various groups according to their linguistic relations, as fixed by the best authorities. But the profoundest scholar can not be complete in all specialties. It did not occur to the illustrious historian that the distinction of language was significant of a similar distinction in character and customs; and thus, in his subsequent general description of the Indians, he has, like many other writers, been induced to ascribe to them common usages and traits to a greater extent than the facts will fairly warrant. It is true that similar surroundings, together with close intercourse continued for ages, had made a certain superficial resemblance among the various groups of American aborigines within the earlier limits of the United States; but more careful inquiry discloses the radical unlikeness, as decided in many other characteristics as in language. It was inevitable that a special acquaintance with the tribes of the far-extended Algonkin family, with which the English colonists were first and longest in contact, should have colored all their ideas of the Indians. Thus the native habitation which Bancroft describes with his usual graphic clearness—but ascribing it to all the tribes—was simply the slight and temporary shelter of the restless Algonkin rovers. "With long poles fixed in the ground, and bent toward each other at the top, covered with birch or chestnut bark, and hung on the inside with embroidered mats, having no door but a loose skin, no hearth but the ground, no chimney but an opening in the roof, the wigwam was quickly constructed and as easily removed." Widely unlike this flimsy Algonkin tent was the permanent "long-house" of the Huron-Iroquois towns—a regularly-framed dwelling, having firm sidewalls and rafter-ed roof, and sometimes extended to the length of a hundred feet,

the capacious habitation of many families. Utterly unlike both of these was the original dwelling of the Dakota race, as seen among the Mandans and Minnetarees, a spacious semicircular structure, partly sunk in the ground, strongly framed and roofed with timber, and covered thickly with earth.

In their religious beliefs the Indians of the several stocks differed as widely from one another as the Arabs differ from the Hindoos, or the Malays from the Japanese. The principal divinity of the Algonkin tribes, known under various names, *Glooskap* among the Penobscots and Micmacs of the far east, *Nanabush* and *Manabosho* among the Delawares and Ojibways, *Napiu* (the Old One) among the Blackfeet of the Northwestern plains, is everywhere the same, and is certainly one of the strangest creations of any mythology—a sort of Jupiter-Scapin, half god and half buffoon, who could only have originated among a people in whom the sense of mirthfulness was stronger than the spirit of reverence. Of a totally different character is the grand tutelary deity of the grave Huron-Iroquois people, known as *Taronhiawagon* (Holder of the Heavens), or *Rawenniyo* (our Great Master)—a deity nobler in character and attributes than any of the Aryan divinities. Singularly unlike both the Algonkin and the Iroquois mythologies is that of the fanciful and intensely religious Dakotas, as we find it described in the excellent work of the Rev. S. R. Riggs, "The Bible among the Dakotas." No more remarkable set of deities, and no more surprising contrast to those of their nearest neighbors, the light-hearted Ojibways, could well be imagined than these extraordinary beings—the *Oon-ktay-he*, or gods of "vital energy"; the *Takoo-shkan-shkan*, or "moving god," who is "too subtile to be perceived by the senses," who "is everywhere present," who "exerts a controlling influence over instinct, intellect, and passion"; and the *Ha-yo-ka*, or "anti-natural god," with whom all things work by the rule of contrary—to whom joy seems grief, and misery brings joy—who shivers in summer and swelters in winter—to whom good is evil, and evil is good. Equally evident to any close observer, but too numerous to be now described, are the wide differences in modes of government, in social systems, and in domestic habits among the Indian communities belonging to the different stocks. Finally—or perhaps it should be said, primarily—each stock has its own psychology, or special traits of intellect and character, of which language, religion, government, and social usages are the natural and necessary manifestations.

We conclude, then, that the true elements and bases of ethnological science are found in linguistic stocks. The number of these is not yet fully ascertained, but is probably not less than three hundred, of which the greater portion belong to the Western Hemisphere. The origin of these stocks is a much-disputed question; but every theory which has been proposed respecting it recognizes the fact that the tribe or people who first spoke the mother-tongue of each stock must have had

a common origin, and must have been for a considerable time isolated from all other tribes. During this long period of early isolation, not only was a language formed distinct in vocabulary and grammar from all others, but a peculiar mental and moral character was developed. Each stock had also its special religion, a fact, in America, now recognized by the most experienced observers. Of course, there has been a great mixture of religions, as there has been a great mixture of languages. Most of the Aryan nations, outside of Hindostan, have adopted some form of the Semitic religion; and most of the Dravidian tribes in the south of India have adopted an Aryan religion; but these changes do not prevent us from recognizing the fact that the Aryan, Semitic, and Dravidian religions were originally distinct.

Language, character, and religion do not alone distinguish an original stock. While these characteristics were forming, others not less important were developed. In each stock there was a peculiar social organization, suited to the character and circumstances of the people. Each stock had its own frame of society and government, its own modes of life, and its own industrial and decorative arts. It will, of course, be understood that along with the differences arising from this separate origin there would be resemblances, springing from similarity of circumstances and from the common principles of the human character and intellect. This truth has been well expressed by Professor Putnam, in his recent essay on "Conventionalism in Ancient American Art." "There is now," he remarks, "sufficient evidence to show that the artistic powers of man, like the languages, were developed in distinct centers, from primitive forms of expression, which had necessarily principles in common." We know, also, that arts and institutions are much more readily adopted from other communities than languages; but skilled and scientific observers, like Putnam, Brinton, Mason, Cushing, Dall, Boas, and the many other able investigators who, on our continent, are now engaged in this research, will usually be able to detect these transferences, and to trace back each invention to its peculiar center.

The assertion which is often made, that language is more variable than physical traits, does not stand the test of facts. Language varies little, if at all, through the influences of climate, while physical characteristics—color, hair, stature, and the like—vary widely and rapidly from this cause. The Aryan languages, from Hindostan to Iceland, are radically the same; but the physical differences in the people who speak them are very great. It may be said that these differences are due to minglings with other races, which to a certain extent is doubtless true; but the striking and significant fact remains that the complexion varies throughout very closely in accordance with the climate. The physical differences among the widely-scattered tribes of the Malayo-Polynesian family, from Madagascar to Hawaii, are far more strongly marked than the differences in their dialects. In Africa, the

tribes of the Hamitic family, speaking allied languages, vary notably with the climate. The Gallas and Somalis, near the equator, have dark-brown skins and frizzly hair, while their kindred, the Berbers of North Africa, have, in the plains, olive complexions and wavy brown or black hair—and in the mountain valleys, where the climate reminds one of Germany, often display fair skins and reddish or blonde hair, which take our thoughts back to the same country. Here, too, admixtures of negro, Vandal, and other races have been needlessly suggested, to account for facts which the differences of climate sufficiently explain.

But we have examples before our eyes. The differences which have been caused solely by climate, in two or three centuries, between Anglo-Americans and Englishmen, and between Spanish-Americans and Spaniards, are certainly much greater than the differences of language. In Australia, while the language remains unaltered, two generations have sufficed to give rise to a distinct variety of the English "breed of men." It is somewhat surprising that with these examples in full view, and with the many like instances which have been accumulated by Pritchard, Darwin, Quatrefages, and other writers—and in face, too, of the well-known facts that the Semitic, the Chinese, and the Aryan tongues have remained radically unaltered for thousands of years—the delusive notion should still be entertained that physical traits are more permanent than language.

Those who deny the necessary connection of race and language argue that an individual can not change the physical traits which show his origin, while he can, and often does, change his language. But it should be remembered that an individual never thus adopts a new language unless when residing among the people who speak it, and among whom, if he remains and has descendants, these must become intermingled and absorbed. In like manner a community, as has been shown, never adopts a new language except under the direct pressure of a stronger population, with which it ultimately becomes united in one people of mixed blood. If, in this mingled race, one element is much stronger than the other, the weaker element is finally absorbed, leaving perhaps little or no apparent trace, either in the language or the aspect of the population. If both elements are strong, the aspect of the people and the form of the language alike show evidence of the mixture. The fact, therefore, remains that language is the indication, and the only sure indication, of the origin of a community.

But how, then, it may be asked, are we to determine the position of those prehistoric populations, of whom such remarkable traces have been brought to light—the "river-drift men," the "cave men," the lake-dwellers, the mound-builders, the cliff-dwellers—whose languages are utterly unknown? The answer is, that this is a matter which belongs solely to anthropology, and in no manner to ethnology. Much can be learned, of the highest interest and importance, about the men

of these vanished tribes—their form and stature, their arts, their mental capacity, their state of civilization; but the races, ethnologically speaking, to which they belonged, can not be ascertained, except by other data than those which we now possess. Whether they were Aryan, Iberian, Uralian, Semitic, Eskimo, Algonkin, Dakotan, Zuñi, Navajo, or whether they belonged, as Prof. Boyd Dawkins supposes of the river-drift men, to a race now utterly extinct, will never be known, unless, as in the case of the Assyrian mounds, some relics are discovered from which their speech can be ascertained. Until this is learned, their affiliations of race will be merely matter of conjecture; and conjecture is not science. As soon as the language is determined, the race will be known. The instant assent which every ethnologist will give to this assertion proves at once, without need of further argument, the truth of the proposition that language is the sole test of race. As the proper deductions from the foregoing facts and arguments, the following propositions are presented for the consideration of anthropologists:

1. The only sure and scientific method of grouping the tribes of men, to show their descent and affiliations, is by the evidence of language. The grouping of men by their languages constitutes the science of ethnology.

2. Ethnologically speaking, the terms "race" and "linguistic stock" are synonymous. The people of each linguistic stock, in their original and unmixed condition, are distinguished from those of other stocks by various peculiarities of physical traits and character, as well as of religion, customs, and arts. The physical differences may, in certain cases, be comparatively slight, as among the American aborigines, and the stocks of Central Africa; but to a practiced eye they are always apparent. When the differences in this respect between two stocks are slight, the inference is simply that, since those stocks originated, the climatic and other influences which affect the physical type have been nearly the same for both.

3. Whenever a mixture of races is indicated in any community by peculiarities of physical traits which can not be ascribed to climate or other natural causes, the language, on a careful analysis, will always show traces of a corresponding mixture; and, on the other hand, a mixture of languages belonging to different linguistic stocks is an invariable indication of a mixture of blood.

To sum up briefly our conclusions, a scientific treatise on ethnology will commence, like a treatise on chemistry, with the primary elements, which, as has been said, are the linguistic stocks. It will determine, as far as possible, the mother-tongue and the original geographical center of each stock. It will describe the moral and intellectual traits and the physical characteristics of the people. It will ascertain their mythology, their social system, their industries, and arts. It will trace their migrations, their interminglings with other septs, and the moral

and physical changes caused by these wanderings and mixtures, and by climate, soil, food, manner of life, and all other influences. And finally, from ascertaining what has been, it will seek to determine what is to come, and to show us something of the future which the human species, in its various divisions, may expect to attain.

And this brings us to the important question of the practical value of the science. However highly we may think of the pursuit of knowledge for its own sake, the common judgment of mankind will require that every science which claims its attention and regard shall justify the claim by results, or, in the Baconian phrase, by its "fruit." What, then, have been the fruits of this science of what may be termed "linguistic ethnology," even in its present condition of imperfect development? We may take two notable examples: the one of the benefit it has yielded, the other of the penalty which has followed its neglect.

When the people of Hindostan, in the last century, came under the British power, they were regarded as a debased and alien race. Their complexion reminded their conquerors of Africa. Their divinities were hideous monsters. Their social system was anti-human and detestable. Suttee, thuggee, Juggernaut, all sorts of cruel and shocking abominations, seemed to characterize and degrade them. The proudest Indian prince was, in the sight and ordinary speech of the rawest white subaltern, only a "nigger." This universal contempt was retorted with a hatred as universal and threatening in the future most disastrous consequences to the British rule. Then came an unexpected and wonderful discovery. European philologists, studying the language of the conquered race, discovered that the classic mother-tongue of Northern Hindostan was the elder sister of the Greek, the Latin, the German, and the Celtic languages. At the same time a splendid literature was unearthed, which filled the scholars of Europe with astonishment and delight. The despised Asiatics became not only the blood-relations, but the teachers and exemplars, of their conquerors. The revulsion of feeling on both sides was immense. Mutual esteem and confidence, to a large extent, took the place of repulsion and distrust. Even in the mutiny which occurred while the change was yet in progress, a very large proportion of the native princes and people refused to take part in the outbreak. Since that time the good-will has steadily grown with the fellowship of common studies and aims. It may fairly be affirmed, at this day, that the discovery of the Sanskrit language and literature has been of more value to England, in the retention and increase of her Indian Empire, than an army of a hundred thousand men.

In an opposite quarter the teachings of ethnology have been unhappily misunderstood and disregarded. The Celtic language is known to be, in the main, an Aryan speech, one of the sisters, as has just been said, of the Sanskrit, the Greek, and the German. But politicians have failed to heed the warning which philologists have given them, that the Celts themselves are a mixed race. Their language

bears evidence of this fact, as clearly as the speech of Hispaniola. The broken and distorted vocables, the imperfect and irregular grammar, with many non-Aryan words, show plainly enough that an allophylian people have here adopted the tongue of Aryan intruders, with whom they have amalgamated. This aboriginal people, according to all the evidence we possess, was of Iberian blood; and what the Iberians were we know very well, from their history in Northern Spain and Southern France. Of all the European communities they have displayed the spirit of independence in the strongest degree. Their attachment to their "*fueros*," or communal rights, has been a steady and unquenchable flame. Under the most absolute of the Spanish sovereigns, their right of self-government was usually respected. Any infringement of it awoke indignation, which, if it smoldered for a time, was sure in the end to break out in a fury of rebellion. Such were the people whose national traits form the groundwork of the Celtic character, more especially in Ireland, where the aboriginal tribes were the strongest. A wise statesmanship, dealing with such a people, would, above all things, have sought to gratify their passion for local self-government and for personal independence. How utterly this sentiment has been disregarded, and with what deplorable consequences, the world knows too well.

It would be easy to cite many other examples of the importance of ethnological teachings, shown alike when they are received and when they are rejected. But the ethnology which thus undertakes to teach must be the genuine science, which is based on the only sure foundation—that of language. Anything else which may style itself ethnology is a mere collection of empirical facts, leading to no assured conclusions—and, however entertaining and instructive in some respects, is not really entitled to the name of a science. The true ethnology, on the other hand, is a genuine science of the highest value. Every educated man should be familiar with its principles and their application. It is indispensable alike to the historian who would trace the past of a nation, and to the politician who in any capacity aspires to direct its future.

THE official report of the operation of the Cruelty to Animals Act gives the number of experiments made upon living animals last year in Great Britain as 1,035. The use of anæsthetics was dispensed with in 458 cases not painful enough to require it; 213 cases were subject to the condition that the animal should be killed before recovering consciousness; and forty operations were painful in their character, while the amount of pain actually inflicted was nevertheless small. Fifty-four of the sixty-four persons holding licenses performed operations. The "Lancet" sees in this return evidence that on the whole the demands of science were reconciled with the infliction of a very small total of pain and inconvenience upon its victims; and it remarks that, when our business and sports come to be conducted with equal consideration for the brute interests involved, we shall be able to congratulate ourselves on having deserved well indeed of the brute creation.

SCIENCE AND THE BISHOPS.

By Professor T. H. HUXLEY, F. R. S.

IF there is any truth in the old adage that a burned child dreads the fire, I ought to be very loath to touch a sermon while the memory of what befell me on a recent occasion, possibly not yet forgotten by the readers of this Review, is uneffaced. But I suppose that even the distinguished censor of that unheard-of audacity to which not even the newspaper report of a sermon is sacred, can hardly regard a man of science as either indelicate or presumptuous, if he ventures to offer some comments upon three discourses, specially addressed to the great assemblage of men of science which recently gathered at Manchester, by three bishops of the State Church. On my return to England not long ago, I found a pamphlet,* containing a version, which I presume to be authorized, of these sermons, among the huge mass of letters and papers which had accumulated during two months' absence; and I have read them not only with attentive interest, but with a feeling of satisfaction which is quite new to me as a result of hearing or reading sermons. These excellent discourses, in fact, appear to me to signalize a new departure in the course adopted by theology toward science, and to indicate the possibility of bringing about an honorable *modus vivendi* between the two. How far the three bishops speak as accredited representatives of the Church is a question to be considered by-and-by. Most assuredly, I am not authorized to represent any one but myself. But I suppose that there must be a good many people in the Church of the bishops' way of thinking; and I have reason to believe that in the ranks of science there are a good many persons who, more or less, share my views. And it is to these sensible people on both sides, as the bishops and I must needs think those who agree with us, that my present observations are addressed. They will probably be astonished to learn how insignificant, in principle, their differences are.

It is impossible to read the discourses of the three prelates without being impressed by the knowledge which they display, and by the spirit of equity, I might say of generosity, toward science which pervades them. There is no trace of that tacit or open assumption that the rejection of theological dogmas, on scientific grounds, is due to moral perversity, which is the ordinary note of ecclesiastical homilies on this subject, and which makes them look so supremely silly to men whose lives have been spent in wrestling with these questions. There is no attempt to hide away real stumbling-blocks under rhetorical stucco; no resort to

* "The Advance of Science." Three sermons preached in Manchester Cathedral on Sunday, September 4, 1887, during the meeting of the British Association for the Advancement of Science, by the Bishop of Carlisle, the Bishop of Bedford, and the Bishop of Manchester.

the *tu quoque* device of setting scientific blunders against theological errors; no suggestion that an honest man may keep contradictory beliefs in separate pockets of his brain; no question that the method of scientific investigation is valid, whatever the results to which it may lead; and that the search after truth, and truth only, ennobles the searcher and leaves no doubt that his life, at any rate, is worth living. The Bishop of Carlisle declares himself pledged to the belief that "the advancement of science, the progress of human knowledge, is in itself a worthy aim of the greatest effort of the greatest minds."

How often was it my fate, a quarter of a century ago, to see the whole artillery of the pulpit brought to bear upon the doctrine of evolution and its supporters! Any one unaccustomed to the amenities of ecclesiastical controversy would have thought we were too wicked to be permitted to live. But let us hear the Bishop of Bedford. After a perfectly frank statement of the doctrine of evolution and some of its obvious consequences, that learned prelate pleads, with all earnestness, against

> a hasty denunciation of what *may* be proved to have at least some elements of truth in it, a contemptuous rejection of theories which we *may* some day learn to accept as freely and with as little sense of inconsistency with God's word as we now accept the theory of the earth's motion round the sun, or the long duration of the geological epochs (p. 28).

I do not see that the most convinced evolutionist could ask any one, whether cleric or layman, to say more than this; in fact, I do not think that any one has a right to say more with respect to any question about which two opinions can be held, than that his mind is perfectly open to the force of evidence.

There is another portion of the Bishop of Bedford's sermon which I think will be warmly appreciated by all honest and clear-headed men. He repudiates the views of those who say that theology and science

> occupy wholly different spheres, and need in no way intermeddle with each other. They revolve, as it were, in different planes, and so never meet. Thus we may pursue scientific studies with the utmost freedom, and, at the same time, may pay the most reverent regard to theology, having no fears of collision, because allowing no points of contact (p. 29).

Surely every unsophisticated mind will heartily concur with the bishop's remark upon this convenient refuge for the descendants of Mr. Facing-both-ways. "I have never been able to understand this position, though I have often seen it assumed." Nor can any demurrer be sustained when the bishop proceeds to point out that there are, and must be, various points of contact between theological and natural science, and therefore that it is foolish to ignore or deny the existence of as many dangers of collision.

Finally, the Bishop of Manchester freely admits the force of the

objections which have been raised, on scientific grounds, to prayer, and attempts to turn them by arguing that the proper objects of prayer are not physical but spiritual. He tells us that natural accidents and moral misfortunes are not to be taken for moral judgments of God; he admits the propriety of the application of scientific methods to the investigation of the origin and growth of religions; and he is as ready to recognize the process of evolution there as in the physical world. Mark the following striking passage:

> And how utterly all the common objections to Divine revelation vanish away when they are set in the light of this theory of a spiritual progression. Are we reminded that there prevailed, in those earlier days, views of the nature of God and man, of human life and Divine Providence, which we now find to be untenable? *That*, we answer, is precisely what the theory of development presupposes. If early views of religion and morality had not been imperfect, where had been the development? If symbolical visions and mythical creations had found no place in the early Oriental expression of Divine truth, where had been the development? The sufficient answer to ninety-nine out of a hundred of the ordinary objections to the Bible, as the record of a Divine education of our race, is asked in that one word—development. And to what are we indebted for that potent word, which, as with the wand of a magician, has at the same moment so completely transformed our knowledge and dispelled our difficulties? To modern science, resolutely pursuing its search for truth in spite of popular obloquy, and—alas! that one should have to say it—in spite too often of theological denunciation (p. 53).

Apart from its general importance, I read this remarkable statement with the more pleasure, since, however imperfectly I may have endeavored to illustrate the evolution of theology in a paper published in this Review last year, it seems to me that in principle, at any rate, I may hereafter claim high theological sanction for the views there set forth.

If theologians are henceforward prepared to recognize the authority of secular science in the manner and to the extent indicated in the Manchester trilogy; if the distinguished prelates who offer these terms are really plenipotentiaries, then, so far as I may presume to speak on such a matter, there will be no difficulty about concluding a perpetual treaty of peace, and indeed of alliance, between the high contracting powers, whose history has hitherto been little more than a record of continual warfare. But if the great chancellor's maxim, "Do ut des," is to form the basis of negotiation, I am afraid that secular science will be ruined; for it seems to me that theology, under the generous impulse of a sudden conversion, has given all that she hath; and indeed, on one point, has surrendered more than can reasonably be asked.

I suppose I must be prepared to face the reproach which attaches to those who criticise a gift, if I venture to observe that I do not think that the Bishop of Manchester need have been so much alarmed

as he evidently has been, by the objections which have often been raised to prayer, on the ground that a belief in the efficacy of prayer is inconsistent with a belief in the constancy of the order of Nature.

The bishop appears to admit that there is an antagonism between the "regular economy of Nature" and the "regular economy of prayer" (p. 39), and that "prayers for the interruption of God's natural order" are of "doubtful validity" (p. 42). It appears to me that the bishop's difficulty simply adds another example to those which I have several times insisted upon in the pages of this Review and elsewhere, of the mischief which has been done, and is being done, by a mistaken apprehension of the real meaning of "natural order" and "law of Nature."

May I, therefore, be permitted to repeat, once more, that the statements denoted by these terms have no greater value or cogency than such as may attach to generalizations from experience of the past, and to expectations for the future based upon that experience? Nobody can presume to say what the order of Nature must be; all that the widest experience (even if it extended over all past time and through all space), that events had happened in a certain way could justify, would be a proportionally strong expectation that events will go on so happening, and the demand for a proportional strength of evidence in favor of any assertion that they had happened otherwise.

It is this weighty consideration, the truth of which every one who is capable of logical thought must surely admit, which knocks the bottom out of all *a priori* objections either to ordinary "miracles" or to the efficacy of prayer, in so far as the latter implies the miraculous intervention of a higher power. No one is entitled to say *a priori* that any given so-called miraculous event is impossible; and no one is entitled to say *a priori* that prayer for some change in the ordinary course of Nature can not possibly avail.

The supposition that there is any inconsistency between the acceptance of the constancy of natural order and a belief in the efficacy of prayer, is the more unaccountable as it is obviously contradicted by analogies furnished by everyday experience. The belief in the efficacy of prayer depends upon the assumption that there is somebody, somewhere, who is strong enough to deal with the earth and its contents as men deal with the things and events which they are strong enough to modify or control; and who is capable of being moved by appeals such as men make to one another. This belief does not even involve theism; for our earth is an insignificant particle of the solar system, while the solar system is hardly worth speaking of in relation to the All; and, for anything that can be proved to the contrary, there may be beings endowed with full powers over our system, yet, practically, as insignificant as ourselves in relation to the universe. If any one pleases, therefore, to give unrestrained liberty to his fancy, he may plead analogy in favor of the dream that there may be, some-

where, a finite being, or beings, who can play with the solar system as a child plays with a toy; and that such being may be willing to do anything which he is properly supplicated to do, For we are not justified in saying that it is impossible for beings having the nature of men, only vastly more powerful, to exist; and if they do exist, they may act as and when we ask them to do so, just as our brother men act. As a matter of fact, the great mass of the human race has believed, and still believes, in such beings, under the various names of fairies, gnomes, angels, and demons. Certainly I do not lack faith in the constancy of natural order. But I am not less convinced that if I were to ask the Bishop of Manchester to do me a kindness which lay within his power, he would do it. And I am unable to see that his action on my request involves any violation of the order of Nature. On the contrary, as I have not the honor to know the bishop personally, my action would be based upon my faith in that "law of Nature," or generalization from experience, which tells me that, as a rule, men who occupy the bishop's position are kindly and courteous. How is the case altered if my request is preferred to some imaginary superior being, or to the Most High Being, who, by the supposition, is able to arrest disease, or make the sun stand still in the heavens, just as easily as I can stop my watch, or make it indicate any hour that pleases me?

I repeat that it is not upon any *a priori* considerations that objections, either to the supposed efficacy of prayer in modifying the course of events, or to the supposed occurrence of miracles, can be scientifically based. The real objection, and, to my mind, the fatal objection, to both these suppositions, is the inadequacy of the evidence to prove any given case of such occurrences which has been adduced. It is a canon of common sense, to say nothing of science, that the more improbable a supposed occurrence, the more cogent ought to be the evidence in its favor. I have looked somewhat carefully into the subject, and I am unable to find in the records of any miraculous event evidence which even approximates to the fulfilment of this requirement.

But, in the case of prayer, the bishop points out a most just and necessary distinction between its effect on the course of Nature outside ourselves and its effect within the region of the supplicator's mind.

It is a "law of Nature," verifiable by everyday experience, that our already-formed convictions, our strong desires, our intent occupation with particular ideas, modify our mental operations to a most marvelous extent, and produce enduring changes in the direction and in the intensity of our intellectual and moral activities.

Men can intoxicate themselves with ideas as effectually as with alcohol or with bang, and produce, by dint of intense thinking, mental conditions hardly distinguishable from monomania. Demoniac possession is mythical; but the faculty of being possessed, more or less completely, by an idea is probably the fundamental condition of

what is called genius, whether it show itself in the saint, the artist, or the man of science. One calls it faith, another calls it inspiration, a third calls it insight; but the "intending of the mind," to borrow Newton's well-known phrase, the concentration of all the rays of intellectual energy on some one point, until it glows and colors the whole cast of thought with its peculiar light, is common to all.

I take it that the Bishop of Manchester has psychological science with him when he insists upon the subjective efficacy of prayer in faith, and on the seemingly miraculous effects which such intending of the mind upon religious and moral ideals may have upon character and happiness. Scientific faith, at present, takes it no further than the prayer which Ajax offered; but that petition is continually granted.

Whatever points of detail may yet remain open for discussion, however, I repeat the opinion I have already expressed that the Manchester sermons concede all that science has an indisputable right, or any pressing need, to ask, and that not grudgingly but generously; and, if the three bishops of 1887 carry the Church with them, I think they will have as good title to the permanent gratitude of posterity as the famous seven who went to the Tower in defense of the Church two hundred years ago.

Will their brethren follow their just and prudent guidance? I have no such acquaintance with the currents of ecclesiastical opinion as would justify me in even hazarding a guess on such a difficult topic. But some recent omens are hardly favorable. There seems to be an impression abroad—I do not desire to give any countenance to it—that I am fond of reading sermons. From time to time, unknown correspondents—some apparently animated by the charitable desire to promote my conversion, and others unmistakably anxious to spur me to the expression of wrathful antagonism—favor me with reports or copies of such productions.

I found one of the latter category among the accumulated arrears to which I have already referred.

It is a full, and apparently accurate, report of a discourse by a person of no less ecclesiastical rank than the three authors of the sermons I have hitherto been considering; but who he is, and where or when the sermon was preached, are secrets which wild horses shall not tear from me, lest I fall again under high censure for attacking a clergyman. Only if the editor of this Review thinks it his duty to have independent evidence that the sermon has a real existence, will I, in the strictest confidence, communicate it to him.

The preacher, in this case, is of a very different mind from the three bishops—and this mind is different in quality, different in spirit, and different in contents. He discourses on the *a priori* objections to miracles, apparently without being aware, in spite of all the discussions of the last seven or eight years, that he is doing battle with a shadow.

I trust I do not misrepresent the Bishop of Manchester in saying that the essence of his remarkable discourse is the insistence upon the "supreme importance of the purely spiritual in our faith," and of the relative, if not absolute, insignificance of aught else. He obviously perceives the bearing of his arguments against the alterability of the course of outward Nature by prayer, on the question of miracles in general; for he is careful to say that "the possibility of miracles, of a rare and unusual transcendence of the world order, is not here in question" (p. 38). It may be permitted me to suppose, however, that, if miracles were in question, the speaker who warns us "that we must look for the heart of the absolute religion in that part of it which prescribes our moral and religious relations" (p. 46), would not be disposed to advise those who had found the heart of Christianity to take much thought about its miraculous integument.

My anonymous sermon will have nothing to do with such notions as these, and its preacher is not too polite, to say nothing of charitable, toward those who entertain them.

> Scientific men, therefore, are perfectly right in asserting that Christianity rests on miracles. If miracles never happened, Christianity, in any sense which is not a mockery, which does not make the term of none effect, has no reality. I dwell on this because there is now an effort making to get up a non-miraculous, invertebrate Christianity, which may escape the ban of science. And I would warn you very distinctly against this new contrivance. Christianity is essentially miraculous, and falls to the ground if miracles be impossible.

Well, warning for warning. I venture to warn this preacher and those who, with him, persist in identifying Christianity with the miraculous, that such forms of Christianity are not only doomed to fall to the ground, but that, within the last half-century, they have been driving that way with continually accelerated velocity.

The so-called religious world is given to a strange delusion. It fondly imagines that it possesses the monopoly of serious and constant reflection upon the terrible problems of existence; and that those who can not accept its shibboleths are either mere Gallios, caring for none of these things, or libertines desiring to escape from the restraints of morality. It does not appear to have entered the imaginations of these people that outside their pale, and firmly resolved never to enter it, there are thousands of men, certainly not their inferiors in character, capacity, or knowledge of the questions at issue, who estimate those purely spiritual elements of the Christian faith of which the Bishop of Manchester speaks as highly as the bishop does, but who will have nothing to do with the Christian churches, because in their apprehension, and for them, the profession of belief in the miraculous, on the evidence offered, would be simply immoral.

So far as my experience goes, men of science are neither better nor worse than the rest of the world. Occupation with the endlessly great parts of the universe does not necessarily involve greatness of charac-

ter, nor does microscopic study of the infinitely little always produce humility. We have our full share of original sin; need, greed, and vainglory beset us as they do other mortals; and our progress is, for the most part, like that of a tacking ship, the resultant of opposite divergencies from the straight path. But, for all that, there is one moral benefit which the pursuit of science unquestionably bestows. It keeps the estimate of the value of evidence up to the proper mark; and we are constantly receiving lessons, and sometimes very sharp ones, on the nature of proof. Men of science will always act up to their standard of veracity, when mankind in gereral leave off sinning; but that standard appears to me to be higher among them than in any other class of the community.

I do not know any body of scientific men who could be got to listen without the strongest expressions of disgusted repudiation to the exposition of a pretended scientific discovery, which had no better evidence to show for itself than the story of the devils entering a herd of swine, or of the fig-tree that was blasted for bearing no figs when "it was not the season of figs." Whether such events are possible or impossible, no man can say; but scientific ethics can and does declare that the profession of belief in them, on the evidence of documents of unknown date and of unknown authorship, is immoral. Theological apologists who insist that morality will vanish if their dogmas are exploded, would do well to consider the fact that, in the matter of intellectual veracity, science is already a long way ahead of the churches; and that, in this particular, it is exerting an educational influence on mankind of which the churches have shown themselves utterly incapable.

Undoubtedly that varying compound of some of the best and some of the worst elements of Paganism and Judaism, molded in practice by the innate character of certain people of the Western world, which since the second century has assumed to itself the title of orthodox Christianity, "rests on miracles," and falls to the ground, not "if miracles be impossible," but if those to which it is committed prove themselves unable to fulfill the conditions of honest belief.

That this Christianity is doomed to fall is, to my mind, beyond a doubt; but its fall will be neither sudden nor speedy. The Church, with all the aid lent it by the secular arm, took many centuries to extirpate the open practice of pagan idolatry within its own fold; and those who have traveled in Southern Europe will be aware that it has not extirpated the essence of such idolatry even yet. *Mutato nomine*, it is probable that there is as much sheer fetichism among the Roman populace now as there was eighteen hundred years ago; and if Marcus Antoninus could descend from his horse and ascend the steps of the Ara Cœli church about Twelfth Day, the only thing that need strike him would be the extremely contemptible character of the modern idols as works of art.

Science will certainly neither ask for, nor receive, the aid of the secular arm. It will trust to the much better and more powerful help of that education in scientific truth and in the morals of assent which is rendered as indispensable as it is inevitable by the permeation of practical life with the products and ideas of science. But no one who considers the present state of even the most developed countries can doubt that the scientific light that has come into the world will for a long time have to shine in the midst of darkness. The urban populations, driven into contact with science by trade and manufacture, will more and more receive it, while the *pagani* will lag behind. Let us hope that no Julian may arise among them to head a forlorn hope against the enevitable. Whatever happens, Science may bide her time in patience and in confidence.

But to return to my "Anonymous." I am afraid that if he represents any great party in the Church, the spirit of justice and reasonableness which animates the three bishops has as slender chance of being imitated, on a large scale, as their common sense and their courtesy. For, not contented with misrepresenting science on its speculative side, "Anonymous" attacks its morality.

> For two whole years investigations and conclusions which would upset the theories of Darwin on the formation of coral islands were actually suppressed, and that by the advice even of those who accepted them, *for fear of upsetting the faith and disturbing the judgment formed by the multitude on the scientific character—the infallibility—of the great master!*

So far as I know anything about the matters which are here referred to, the part of this passage which I have italicized is absolutely untrue. I believe that I am intimately acquainted with all Mr. Darwin's immediate scientific friends; and I say that no one of them, nor any other man of science known to me, ever could, or would, have given such advice to any one—if for no other reason than that, with the example of the most candid and patient listener to objections that ever lived, fresh in their memories, they could not so grossly have at once violated their highest duty and dishonored their friend.

The charge thus brought by "Anonymous" affects the honor and the probity of men of science; if it is true, we have forfeited all claim to the confidence of the general public. In my belief it is utterly false, and its real effect will be to discredit those who are responsible for it. As is the way with slanders, it has grown by repetition. "Anonymous" is responsible for the peculiarly offensive form which it has taken in his hands; but he is not responsible for originating it. He has evidently been inspired by an article entitled, "A Great Lesson," published in the September number of this Review.* Truly it is "a great lesson," but not quite in the sense intended by the giver thereof.

* See "The Popular Science Monthly" for December, 1887.

In the course of his doubtless well-meant admonitions, the Duke of Argyll commits himself to a greater number of statements which are demonstrably incorrect, and which any one who ventured to write upon the subject ought to have known to be incorrect, than I have ever seen gathered together in so small a space.

I submit a gathering from the rich store for the appreciation of the public.

First:

> Mr. Murray's new explanation of the structure of coral reefs and islands was communicated to the Royal Society of Edinburgh in 1880, and supported with such a weight of facts and such a close texture of reasoning, that no serious reply has ever been attempted (see "The Popular Science Monthly," p. 252).

"No serious reply has ever been attempted!" I suppose that the Duke of Argyll may have heard of Professor Dana, whose years of labor devoted to corals and coral-reefs when he was naturalist of the American expedition under Commodore Wilkes, more than forty years ago, have ever since caused him to be recognized as an authority of the first rank on such subjects. Now does his Grace know, or does he not know, that, in the year 1885, Professor Dana published an elaborate paper "On the Origin of Coral Reefs and Islands," in which, after referring to a presidential address by the Director of the Geological Survey of Great Britain and Ireland delivered in 1883, in which special attention is directed to Mr. Murray's views, Professor Dana says:

> The existing state of doubt on the question has led the writer to reconsider the earlier and later facts, and in the following pages he gives his results.

Professor Dana then devotes many pages of his very "serious reply" to a most admirable and weighty criticism of the objections which have at various times been raised to Mr. Darwin's doctrine, by Professor Semper, by Dr. Rein, and finally by Mr. Murray, and he states his final judgment as follows:

> With the theory of abrasion and solution incompetent, all the hypotheses of objectors to Darwin's theory are alike weak; for all have made these processes their chief reliance, whether appealing to a calcareous or a volcanic or a mountain-peak basement for the structure. The subsidence which the Darwinian theory requires has not been opposed by the mention of any fact at variance with it, nor by setting aside Darwin's arguments in its favor; and it has found new support in the facts from the Challenger's soundings off Tahiti, that had been put in array against it, and strong corroboration in the facts from the West Indies.
>
> Darwin's theory, therefore, remains as the theory that accounts for the origin of reefs and islands.*

Be it understood that I express no opinion on the controverted points. I doubt if there are ten living men who, having a practical

* "American Journal of Science," 1885, p. 190.

knowledge of what a coral reef is, have endeavored to master the very difficult biological and geological problems involved in their study. I happen to have spent the best part of three years among coral reefs and to have made that attempt; and, when Mr. Murray's work appeared, I said to myself that until I had two or three months to give to the renewed study of the subject in all its bearings, I must be content to remain in a condition of suspended judgment. In the meanwhile, the man who would be voted by common acclamation as the most competent person now living to act as umpire, has delivered the verdict I have quoted; and, to go no further, has fully justified the hesitation I and others may have felt about expressing an opinion. Under these circumstances, it seems to me to require a good deal of courage to say "no serious reply has ever been attempted"; and to chide the men of science, in lofty tones, for their "reluctance to admit an error" which is not admitted; and for their "slow and sulky acquiescence" in a conclusion which they have the gravest warranty for suspecting!

Second:

> Darwin himself had lived to hear of the new solution, and, with that splendid candor which was eminent in him, his mind, though now grown old in his own early convictions, was at least ready to entertain it, and to confess that serious doubts had been awakened as to the truth of his famous theory (p. 252).

I wish that Darwin's splendid candor could be conveyed by some description of spiritual "microbe" to those who write about him. I am not aware that Mr. Darwin ever entertained "serious doubts as to the truth of his famous theory"; and there is tolerably good evidence to the contrary. The second edition of his work, published in 1876, proves that he entertained no such doubts then; a letter to Professor Semper, whose objections, in some respects, forestalled those of Mr. Murray, dated October 2, 1879, expresses his continued adherence to the opinion "that the atolls and barrier reefs in the middle of the Pacific and Indian Oceans indicate subsidence"; and the letter of my friend Professor Judd, printed at the end of this article (which I had perhaps better say Professor Judd has not seen) will prove that this opinion remained unaltered to the end of his life.

Third:

> . . . Darwin's theory is a dream. It is not only unsound, but it is in many respects the reverse of truth. With all his conscientiousness, with all his caution, with all his powers of observation, Darwin in this matter fell into errors as profound as the abysses of the Pacific (p. 249).

Really? It seems to me that, under the circumstances, it is pretty clear that these lines exhibit a lack of the qualities justly ascribed to Mr. Darwin, which plunges their author into a much deeper abyss, and one from which there is no hope of emergence.

Fourth :

All the acclamations with which it was received were as the shouts of an ignorant mob (p. 249).

But surely it should be added that the Coryphæus of this ignorant mob, the fugelman of the shouts, was one of the most accomplished naturalists and geologists now living—the American Dana—who, after years of independent study extending over numerous reefs in the Pacific, gave his hearty assent to Darwin's views, and, after all that had been said, deliberately reaffirmed that assent in the year 1885.

Fifth :

The overthrow of Darwin's speculation is only beginning to be known. It has been whispered for some time. The cherished dogma has been dropping very slowly out of sight (p. 249).

Darwin's speculation may be right or wrong, but I submit that that which has not happened can not even begin to be known, except by those who have miraculous gifts to which we poor scientific people do not aspire. The overthrow of Darwin's views may have been whispered by those who hoped for it ; and they were perhaps wise in not raising their voices above a whisper. Incorrect statements, if made too loudly, are apt to bring about unpleasant consequences.

Sixth. Mr. Murray's views, published in 1880, are said to have met with "slow and sulky acquiescence" (p. 252). I have proved that they can not be said to have met with general acquiescence of any sort, whether quick and cheerful, or slow and sulky ; and if this assertion is meant to convey the impression that Mr. Murray's views have been ignored, that there has been a conspiracy of silence against them, it is utterly contrary to notorious fact.

Professor Geikie's well-known "Text-book of Geology" was published in 1882, and at pages 457–9 of that work there is a careful exposition of Mr. Murray's views. Moreover, Professor Geikie has specially advocated them on other occasions,* notably in a long article on "The Origin of Coral Reefs," published in two numbers of "Nature" for 1883, and in a presidential address delivered in the same year. If, in so short a time after the publication of his views, Mr. Murray could boast of a convert so distinguished and influential as the Director of the Geological Survey, it seems to me that this wonderful *conspiration de silence* (which has about as much real existence as the Duke of Argyll's other bogie, "the Reign of Terror") must have *ipso facto* collapsed. I wish that, when I was a young man, my endeavors to upset some prevalent errors had met with as speedy and effectual backing.

Seventh :

. . . Mr. John Murray was strongly advised against the publication of his

* Professor Geikie, however, though a strong, is a fair and candid advocate. He says of Darwin's theory, "That it may be possibly true, in some instances, may be readily granted." For Professor Geikie, then, it is not yet overthrown—still less a dream.

views in derogation of Darwin's long-accepted theory of the coral islands, and was actually induced to delay it for two years. Yet the late Sir Wyville Thomson, who was at the head of the naturalists of the Challenger expedition, was himself convinced by Mr. Murray's reasoning (p. 255).

Clearly, then, it could not be Mr. Murray's official chief who gave him this advice. Who was it? And what was the exact nature of the advice given? Until we have some precise information on this head, I shall take leave to doubt whether this statement is more accurate than those which I have previously cited.

Whether such advice was wise or foolish, just or immoral, depends entirely on the motive of the person who gave it. If he meant to suggest to Mr. Murray that it might be wise for a young and comparatively unknown man to walk warily, when he proposed to attack a generalization based on many years' labor of one undoubtedly competent person, and fortified by the independent results of the many years' labor of another undoubtedly competent person, and even, if necessary, to take two whole years in fortifying his position, I think that such advice would have been sagacious and kind. I suppose that there are few working men of science who have not kept their ideas to themselves, while gathering and sifting evidence, for a much longer period than two years.

If, on the other hand, Mr. Murray was advised to delay the publication of his criticisms, simply to save Mr. Darwin's credit and to preserve some reputation for infallibility, which no one ever heard of, then I have no hesitation in declaring that his advisor was profoundly dishonest, as well as extremely foolish, and that, if he is a man of science, he has disgraced his calling.

But, after all, this supposed scientific Achitophel has not yet made good the primary fact of his existence. Until the needful proof is forthcoming, I think I am justified in suspending my judgment as to whether he is much more than an anti-scientific myth. I leave it to the Duke of Argyll to judge of the extent of the obligation under which, for his own sake, he may lie to produce the evidence on which his aspersions of the honor of scientific men are based. I can not pretend that we are seriously disturbed by charges which every one who is acquainted with the truth of the matter knows to be ridiculous; but mud has a habit of staining if it lies too long, and it is as well to have it brushed off as soon as may be.

So much for the "Great Lesson." It is followed by a "Little Lesson" apparently directed against my infallibility—a doctrine about which I should be inclined to paraphrase Wilkes's remark to George III when he declared that he, at any rate, was not a Wilkite. But I really should be glad to think that there are people who need the warning, because then it will be obvious that this raking up of an old story can not have been suggested by a mere fanatical desire to damage men of science. I can but rejoice, then, that these misguided en-

thusiasts, whose faith in me has so far exceeded the bounds of reason, should be set right. But that "want of finish" in the matter of accuracy which so terribly mars the effect of the "Great Lesson," is no less conspicuous in the case of the "Little Lesson," and, instead of setting my too fervent disciples right, it will set them wrong.

The Duke of Argyll, in telling the story of *Bathybius*, says that my mind was "caught by this new and grand generalization of the physical basis of life." I never have been guilty of a reclamation about anything to my credit, and I do not mean to be; but if there is any blame going, I do not choose to be relegated to a subordinate place when I have a claim to the first. The responsibility for the first description and the naming of *Bathybius* is mine and mine only. The paper on "Some Organisms living at Great Depths in the Atlantic Ocean," in which I drew attention to this substance, is to be found by the curious in the eighth volume of the "Quarterly Journal of Microscopical Science," and was published in the year 1868. Whatever errors are contained in that paper are my own peculiar property; but neither at the meeting of the British Association in 1868, nor anywhere else, have I gone beyond what is there stated; except in so far that, at a long subsequent meeting of the association, being importuned about the subject, I ventured to express, somewhat emphatically, the wish that the thing was at the bottom of the sea.

What is meant by my being caught by a generalization about the physical basis of life I do not know; still less can I understand the assertion that *Bathybius* was accepted because of its supposed harmony with Darwin's speculations. That which interested me in the matter was the apparent analogy of *Bathybius* with other well-known forms of lower life, such as the plasmodia of the Myxomycetes and the Rhizopods. Speculative hopes or fears had nothing to do with the matter; and if *Bathybius* were brought up alive from the bottom of the Atlantic to-morrow, the fact would not have the slightest bearing, that I can discern, upon Mr. Darwin's speculations, or upon any of the disputed problems of biology. It would merely be one elementary organism the more added to the thousands already known.

Up to this moment I was not aware of the universal favor with which *Bathybius* was received.* Those simulators of an "ignorant mob" who, according to the Duke of Argyll, welcomed Darwin's theory of coral reefs, made no demonstration in my favor, unless his Grace includes Sir Wyville Thomson, Dr. Carpenter, Dr. Bessels, and Professor Haeckel under that head. On the contrary, a sagacious friend of mine, than whom there was no more competent judge, the

* I find, moreover, that I specially warned my readers against hasty judgment. After stating the facts of observation, I add, "I have, hitherto, said nothing about their meaning, as, in an inquiry so difficult and fraught with interest as this, it seems to me to be in the highest degree important to keep the questions of fact and the questions of interpretation well apart."

late Mr. George Busk, was not to be converted; while, long before the Challenger work, Ehrenberg wrote to me very skeptically, and I fully expected that that eminent man would favor me with pretty sharp criticism. Unfortunately, he died shortly afterward, and nothing from him, that I know of, appeared. When Sir Wyville Thomson wrote to me a brief account of the results obtained on board the Challenger, I sent his statement to "Nature," in which journal it appeared the following week, without any further note or comment than was needful to explain the circumstances. In thus allowing judgment to go by default, I am afraid I showed a reckless and ungracious disregard for the feelings of the believers in my infallibility. No doubt I ought to have hedged and fenced and attenuated the effect of Sir Wyville Thomson's brief note in every possible way. Or perhaps I ought to have suppressed the note altogether, on the ground that it was a mere *ex parte* statement. My excuse is that, notwithstanding a large and abiding faith in human folly, I did not know then, any more than I know now, that there was anybody foolish enough to be unaware that the only people, scientific or other, who never make mistakes are those who do nothing; or that anybody, for whose opinion I cared, would not rather see me commit ten blunders than try to hide one.

Pending the production of further evidence, I hold that the existence of people who believe in the infallibility of men of science is as purely mythical as that of the evil counselor who advised the withholding of the truth lest it should conflict with that belief.

I venture to think, then, that the Duke of Argyll might have spared his "Little Lesson" as well as his "Great Lesson" with advantage. The paternal authority who whips the child for sins he has not committed does not strengthen his moral influence—rather excites contempt and repugnance. And if, as would seem from this and former monitory allocutions which have been addressed to us, the duke aspires to the position of censor, or spiritual director, in relation to the men who are doing the work of physical science, he really must get up his facts better. There will be an end to all chance of our kissing the rod if his Grace goes wrong a third time. He must not say again that "no serious reply has been attempted" to a view which was discussed and repudiated two years before by one of the highest extant authorities on the subject; he must not say that Darwin accepted that which it can be proved he did not accept; he must not say that a doctrine has dropped into the abyss when it is quite obviously alive and kicking at the surface; he must not assimilate a man like Professor Dana to the components of an "ignorant mob"; he must not say that things are beginning to be known which are not known at all; he must not say that "slow and sulky acquiescence" has been given to that which can not yet boast of general acquiescence of any kind; he must not suggest that a view which has been publicly

advocated by the Director of the Geological Survey and no less publicly discussed by many other authoritative writers has been intentionally and systematically ignored; he must not ascribe ill motives for a course of action which is the only proper one; and, finally, if any one but myself were interested, I should say that he had better not waste his time in raking up the errors of those whose lives have been occupied not in talking about science, but in toiling, sometimes with success and sometimes with failure, to get some real work done.

The most considerable difference I note among men is not in their readiness to fall into error, but in their readiness to acknowledge these inevitable lapses. The Duke of Argyll has now a splendid opportunity for proving to the world in which of these categories it is hereafter to rank him.

DEAR PROFESSOR HUXLEY: A short time before Mr. Darwin's death I had a conversation with him concerning the observations which had been made by Mr. Murray upon coral reefs, and the speculations which had been founded upon those observations. I found that Mr. Darwin had very carefully considered the whole subject, and that while, on the one hand, he did not regard the actual facts recorded by Mr. Murray as absolutely inconsistent with his own theory of subsidence, on the other hand, he did not believe that they necessitated or supported the hypothesis advanced by Mr. Murray. Mr. Darwin's attitude, as I understood it, toward Mr. Murray's objections to the theory of subsidence was exactly similar to that maintained by him with respect to Professor Semper's criticism, which was of a very similar character; and his position with regard to the whole question was almost identical with that subsequently so clearly defined by Professor Dana in his well-known articles published in the "American Journal of Science" for 1885.

It is difficult to imagine how any one, acquainted with the scientific literature of the last seven years, could possibly suggest that Mr. Murray's memoir published in 1880 had failed to secure a due amount of attention. Mr. Murray, by his position in the Challenger office, occupied an exceptionally favorable position for making his views widely known; and he had moreover the singular good fortune to secure from the first the advocacy of so able and brilliant a writer as Professor Archibald Geikie, who in a special discourse and in several treatises on geology and physical geology very strongly supported the new theory. It would be an endless task to attempt to give references to the various scientific journals which have discussed the subject, but I may add that every treatise on geology which has been published since Mr. Murray's views were made known has dealt with his observations at considerable length. This is true of Professor A. H. Green's "Physical Geology" published in 1882; of Professor Prestwich's "Geology, Chemical and Physical"; and of

Professor James Geikie's "Outlines of Geology," published in 1886. Similar prominence is given to the subject in De Lapparent's "Traité de Géologie," published in 1885, and in Credner's "Elemente der Geologie" which has appeared during the present year. If this be a "conspiracy of silence," where, alas! can the geological speculator seek for fame? Yours, very truly, JOHN W. JUDD.

October 10, 1887.

—*Nineteenth Century.*

THE OUTCOME OF THE GRANGER MOVEMENT.

BY CHARLES W. PIERSON.

THE founders of the Grange thought they were establishing an order whose aims were to be social and educational. But these were soon overshadowed by the co-operative, anti-middleman feature. This drew more into the order than all other considerations combined, at one time almost threatening to transform our farming population into a race of traders, and this was likewise the chief cause of Grange decay. Fighting middlemen, unlike fighting railroads, was a legitimate kind of activity, as it had nothing to do with politics or theology—the two subjects tabooed by Granger law. Unfortunately, the story of Grange co-operation is recorded nowhere and thoroughly known to nobody. Those who know most preserve a discreet silence, mindful of questionable transactions and failures, now generally forgotten.

No sooner had Kelley established a few Granges in Minnesota in 1869 than they set up a clamor for leasing flouring-mills and appointing agents in St. Paul and New York, in order to mill and ship their own grain. However farcical might be the position of the founders at Washington, they at least were conservative enough to disavow this action. But upon Minnesota's threat to secede they yielded, and an agent was appointed in St. Paul. His first commission chanced to be to buy a jackass for a Patron, whereupon one of the founders made comment: "This purchasing business commenced with buying asses; the prospects are that many will be sold." As soon as the National Grange fell into the hands of farmers, there was a movement to make it the head of a gigantic co-operative scheme. It was proposed to have three national purchasing-agents, stationed at New York, Chicago, and New Orleans, to buy for the Patrons of the whole country. But this was soon seen to be impracticable, owing to the diversity of interests in the order. The same was true with regard to the purchase of patent-rights. With the view of absorbing into the order the profits of manufacturing farming-implements, the National Grange had bought the right to manufacture a harvester, a mower and reaper, and various other machines. It had also tried to buy the copyright of Cushing's "Manual"—a book in great demand among

the Grangers. Meanwhile, the Executive Committee was busy in another direction. Congressman Aiken of South Carolina, one of its members, says that they "visited the manufacturers who supplied the market with such implements as the farmers needed, from a scooter-plow to a parlor-organ, proposing to concentrate the purchases of the order where the greatest discounts were obtained for cash. In no instance did they fail to secure a reduction of twenty-five to fifty per cent." Mr. Aiken notes the astonishment of one cutlery-maker at a single order for ten thousand pruning-knives of a particular pattern. Such enormous reductions from regular prices were obtained only under a pledge of secrecy. But as information had to be distributed by thousands of printed sheets, the Patrons could not keep the secret. The contracts leaked out, causing the withdrawal of many firms from their agreements. What experiments the National Grange might have tried with the great sums in its treasury can only be conjectured, as its resources and influence over the subordinate lodges were crippled almost fatally in the Charleston meeting in 1875. It probably would have continued the crop reports, which, though costly, and often unreliable through the ignorance and carelessness of Granges about furnishing statistics, had proved valuable. Like the State Granges, which had full treasuries, it might have squandered its capital and come to grief on co-operative ventures. Such is the inference to be drawn from utterances like the following, from the Executive Committee: "To secure rights to manufacture leading implements . . . is pre-eminently a duty of the National Grange, and a measure of the greatest importance, directly, because the profits of manufacture will thus be controlled by the Order, as well as the profits of transfer or dealing; indirectly, by securing facilities that will favor the introduction of manufacturing establishments in districts at present far removed from them, and where their products are in demand." The plan of having the farmer's machinery manufactured at his door and under his supervision was much better as a statement of protectionist doctrine than as a guide to safe investment. The policy of the meeting of 1875 indicated that, before it was too late, the National Grange recognized that there was danger of going too fast, and that its province was rather to devise plans for the use of the order than to plunge into enterprises itself. It therefore sounded a note of caution, and first issuing a scheme for co-operative joint-stock stores based on something found in this country, proceeded to work out a more elaborate system on the model of the Rochdale Pioneers. Various English publications on co-operation were distributed among the order, and an envoy was sent to England to confer with English co-operators. The result was a new set of rules, closely following the Rochdale plan, and insisting on the feature of investing the profits of trade for the stockholders on the basis of purchases, as opposed to the simple joint-stock arrangement of the earlier scheme, which had

been largely put in practice. After a prolonged stay, the commissioner to England made his report, bringing from English co-operators proposals for dealings on a grand scale. The Grange was to subscribe one hundred and twenty-five thousand dollars toward the necessary shipping-depots, and all trade was to be carried on directly with England through a company to be known as the "Anglo-American Co-operative Company." The Englishmen followed the matter up by sending three men to the United States to confer with the Executive Committee. After looking over the ground, they proposed to erect their own warehouses at four seaboard cities, prepared to supply every article of clothing and every farm-implement needed by Patrons at a discount of ten per cent, and to receive in exchange every variety of farm-produce at the market price, provided that the Grange would concentrate its purchases upon them. But by this time the ardor of the Patrons had been cooled by reverses in local experiments, and the Executive Committee was unable to make the necessary guarantees. The National Grange's efforts now subsided into protests and warnings against the commission and joint-stock ventures so common in the order, and pleas for the Rochdale system. Many enterprises were undertaken upon this basis, proving, if not highly profitable, at least not disastrous. Some are still in existence, notably the "Texas Co-operative Association." But, in general, the warning came too late. The Patrons had been too impatient to grasp the anticipated gains, and had burned their fingers.

The step from co-operation in the National, to co-operation in the State and District, Granges is one from theory tinged by practice, to practice pure and simple. The craze for co-operation was like that for gold in 1848. The first and simplest step was to appoint a profusion of buying and selling agents, usually on salaries from the State Granges. But a few losses by mismanagement and rascality were enough to deter the farmers from trusting their produce to selling-agents. The system of agencies for buying only was not open to the same risks, but its utility differed in different States. For Iowa, where every farmer raised grain and wanted plows and reapers, an agent could buy to great advantage. The Patrons there gave figures to show that they saved fifty thousand dollars in one year on plows and cultivators alone. In the same year they bought fifteen hundred sewing-machines, at a reduction of forty-five per cent from retail prices. Local dealers were driven out of business. In New York, on the other hand, where the farmers are dairymen, grain-growers, nurserymen, and hop-growers, a State buying-agency was found useless, and was abandoned, after some hard experience, for a system of district agencies. These have effected saving in some instances, in others proved unprofitable, partly owing to the outcroppings of mean human nature among those most clamorous for the benefits. The "State Women's Dress Agency," in New York city, lasted longer, but, strangely enough, the

Patronesses preferred to buy their own dresses, and it finally expired. The States did not stop with agencies. They too began to buy patent-rights. There was an idea that all the principal machinery used by the order should be manufactured within it. Flouring-mills, elevators, tobacco and grain warehouses, were established. Some ventures were unsuccessful from the start, and at once clamored for subsidies. Others boasted of the greatest prosperity, one making a dividend of fifty per cent the first year. In 1874 two thirds of the elevators in Iowa were in Grange hands. The experiment of shipping provisions directly to Southern Grange centers was undertaken. In 1876 the Patrons were said to own five steamboat or packet lines, thirty-two grain-elevators, and twenty-two warehouses. Some of these were local ventures, but the full treasuries of the State Granges furnished the capital for most of them. It is always easy to experiment with other men's money, and the State Grange officials found no difficulty in getting, with the Grange funds, into enterprises where disaster was inevitable. It came in every instance. The blow was so overwhelming in some States (Arkansas and Nebraska for example), that they dropped at once from the order. District Granges disbanded for fear of being held individually liable for State Grange debts, and the very name Granger became a reproach. In other States the Grange was greatly weakened, but survived. In Iowa a few hundred of the faithful have struggled on for years, the officers receiving no salaries, but devoting all receipts to the debt, left as a reminder of past glories. Professor R. T. Ely, in his recent book on "The Labor Movement in America," expatiates on the "grand results" achieved by the Patrons in co-operation, and credits the absurd statement that Grange savings in this way amounted to twelve million dollars in one year! Unfortunately, the greater number of enterprises were "grand" chiefly in failure, a fact of which Professor Ely seems never to have heard. About all that survived the wreck of the later seventies were mutual insurance companies, principally fire-insurance, and co-operative stores. At present, Grange insurance companies are reported from more than half the States and from Canada, and Grange co-operative stores are even more widespread. Successful buying-agencies still exist in five States, and the Delaware Patrons have a fruit-exchange. The most interesting state of things is found in Texas, where there are about one hundred and twenty-five Grange stores established on the modification of the Rochdale rules, and banded together in a State association. This holds annual meetings, contributes two thousand dollars to keep Grange lecturers in the field, and reports steady prosperity.

Much of the later history of the Grange has been anticipated in treating of railroad legislation and co-operation, but its decadence merits a little closer attention. Only those interested in agricultural pursuits were eligible for membership, but, in the unprecedented growth of the order under the labors of twelve hundred deputies, it

was impossible to keep out men who were farmers only to the extent of a garden or back yard. In those days lawyers, doctors, merchants, discovered in themselves a marvelous interest in agricultural pursuits, and joined the Grange. As a Granger remarked, they were interested in agriculture as the hawk is interested in the sparrow. Two Granges were organized in New York city; one, the "Manhattan," on Broadway, with a membership of forty-five wholesale dealers, sewing-machine manufacturers, etc., representing a capital of as many millions; the other, the "Knickerbocker," one of whose first official acts was to present the National Grange with a handsome copy of the Scriptures—a gift causing some embarrassment. A similar one was organized in Boston, which made great trouble before it could be expelled; and one was found in Jersey City, with a general of the army as its master, a stone-mason as secretary, and the owner of a grain-elevator as chaplain. But discordant elements were not all from other professions. Thousands of farmers had been carried in by the enthusiasm of the movement, with no idea of the nature and aims of the order. Some expected to make a political party; others, to smash the railroads; almost all hoped to find in co-operation a panacea for poverty. There was great lack of discipline, but no discipline could have harmonized such a body. The first outbreak was in the direction of democracy. Lay members were eligible to but four of the seven degrees, and this was denounced as aristocratic, opposed to the spirit of democratic institutions. Along with this came the cry that the National Grange was growing too rich. In vain it made liberal donations of seeds and provisions to sufferers by grasshoppers and floods, and spent large sums in distributing crop-reports among the order. The clamor continued till the faint-hearted in the Charleston session in 1875 carried a measure to distribute $55,000 to the subordinate Granges—about $2.50 to each! Prominent Grangers have maintained that the causes of Grange decay are to be found in this and the other measures of the same session curtailing the power of the National Grange. The true cause has been seen to lie deeper, in the failure of business enterprises. These measures had some influence, however. They were the beginnings of endless tinkering with the constitution, and the cause of quarrels innumerable. Among other quarrels was one with the Grange of Canada, over the question of jurisdiction. Soon afterward came the first open break in the ranks. An Illinois Grange voted to disband, alleging pecuniary reasons and the autocratic rule of the National Grange. Many still had dreams that the order was to spread over the world, but the co-operative leaven had begun to work, and there was soon no mistaking the tendency to decay. At the annual meeting in 1876, four thousand Granges were reported delinquent. Salaries were at once reduced—the master's from $2,000 to $1,200, and the secretary's from $2,500 to $2,000. It was vainly attempted to stem the tide by issuing an official organ, the "Grange Record." In 1879 the master's

salary was dropped entirely, and the secretary's reduced to $600. A bill for services from Herr Prenzel, who had been working for the order in Germany since 1875, was dismissed with little ceremony. The National Grange was not poor, having always kept about $50,000 to its credit invested in Government bonds, but it had given up the idea of converting the world. But the low-water mark had been reached. Cash receipts in 1880 increased two hundred per cent over those in 1879. More Granges had been organized than in any year since 1874. The growth was especially marked in New England. The State Grange of Connecticut was revived after a dormancy of six years, and Maine began to claim more Grangers in proportion to population than any other State. At the session of the National Grange for 1885, held in Boston, delegates were present from all the States and Territories but eight. It is not easy to explain this growth, as there seems to be no great principle underlying it. Some New England Patrons are agitating free trade, but that can not be called a Grange issue, as Pennsylvania Patrons want protection extended to farm-products. The harmless practice of holding great fairs is gaining ground. At a recent one in Pennsylvania, lasting a week, the local paper says: "Over fifty thousand people were present on one day, and the sale of machinery direct to the farmers ran up into the hundreds of thousands of dollars. Never were manufacturers and consumers brought into more direct and friendly relations." This is, perhaps, the latest development of Grange anti-middleman ideas.

The most enthusiastic Grangers at present are the farmers' wives and daughters, who are attracted by the social opportunities. In fact, the order seems to be going back to the educational and social basis of the founders, and its boasts are no longer co-operative ventures so much as Grange buildings and libraries, and the Grange schools that exist in several States. In these directions, and in what it has done to heal sectional differences between North and South, the Grange can boast its best achievements.

CLIMATE OF THE LAKE REGION.*

PERIODICAL CHANGES.

By BELA HUBBARD.

CONNECTED with our considerations upon the climate is a subject which has excited great interest since the first settlement of the country, and about which much has been written, for the most part vaguely. I allude to the variations in the levels of the lake-waters. Many causes contribute to create a perpetual fluctuation, or rise and fall, in these inland seas.

* From "Memorials of a Half-Century." New York and London. G. P. Putnam's Sons. 1887.

1. A possible lunar tide; but so small and so broken in upon by greater causes as to be of very uncertain value.

2. The winds, which often cause a difference in level of many feet; strong westerly winds causing a rise at one place, and easterly winds at another. These changes are irregular and transient, but often considerable in amount, ranging from two to five feet.

3. Annual variation attendant upon the seasons and confined to the year. This kind of fluctuation is a winter and summer movement. The supply from streams and rains being wholly or partially checked in the cold season, the water is gradually drawn away, lowering the general level, which reaches its lowest ebb about January or February. As spring advances, with melting snows and increased rainfall, the waters rise gradually, and attain their greatest height in June or July. They then begin to fall again to their winter level. The extreme of this variation is about 2·30 feet, and is about the same in Lake Erie as in Detroit River.

4. A rise and fall of the waters of the lakes and their connecting channels, extending through several years, and amounting to an extreme difference of five feet. Upon this kind of fluctuation Colonel Charles Whittlesey has bestowed the name of "secular variation."

The causes of this variation were long involved in much mystery. According to the old French tradition, it is independent of the seasons, and follows periodical intervals of seven years. To what extent these intervals of high and low water are regular in their recurrence, and how far they are connected with meteorological or astronomical causes, can be determined only after continuous and exact observations for a long series of years.

It is hardly more than a decade since the United States Signal Service has given scientific exactness to observations, and not over thirty years since thoroughly reliable statistics have been tabulated. Records of independent observers often differ widely, and though the writer has culled from different sources data sufficient to enable him to construct a diagram for this region, covering the past fifty years, and even more, many of these data are of uncertain value. For a period of thirty-three years, beginning with 1853, a record has been kept by the Detroit Water Board of the daily fluctuations in the level of the river, and partial records exist of other years since 1835.

In a comparison between the height of water in the river and the rainfall at Detroit, no conclusions drawn from these data will apply rigidly to the lakes above and below. The river-levels are influenced not alone by the precipitation on its borders, but by the supply from above. Other causes contribute to its irregularities—local rains, confined channel, rapid current. While a sudden increase in the precipitation will affect the broad surfaces of the lakes uniformly, a rise would take place at such times in the confined straits to a dispropor-

tionate extent. In discussing this so-called "secular" variation it becomes necessary to procure data from outside sources.

Milwaukee represents well Lake Michigan, and Cleveland Lake Erie. Each is about half-way between the head and foot of the lake upon which it is situated, and where the changes may fairly be considered as means of the whole. From Milwaukee I have a table of the rainfall from 1844 to 1886, and of the "secular" variations of Lake Michigan from 1859 to 1882. From Cleveland, of the rainfall from 1856 to 1886, and of the lake variations since 1859.

At each of these places the standard or plane of reference is the high water of 1838. The standard at Detroit is an arbitrary one, namely, the water-table at the Hydraulic Works. The mean of the last fifty years is five feet below that standard, and corresponds, as nearly as I can determine, to one foot below the *mean* of 1838, and two feet below the extreme of June of that year.

Of the fluctuations of the water prior to the period mentioned the only data are derived from the recollections of old settlers. These, though often indefinite and sometimes faulty, are yet of great value. Dr. Houghton, in his report of 1839, gives certain concordant statements of old inhabitants, going back as far as 1800. In a paper published in "Smithsonian Contributions," volume xii, Colonel Charles Whittlesey has collected items from all sources within his reach, going back as far as 1788. Vague as many of these details are, there is so much that is of definite value, that it seems to me possible to construct a curve of the levels of Lake Erie for the whole period, which should exhibit, with tolerable accuracy, the highest and lowest extremes at least. As I propose to use these aids in formulating certain conclusions, I ought here to give the reader opportunity to form his own judgment as to their value and authority.

To begin, it may be taken as universally admitted that the lakes were at a higher level in 1838 than at any known period before. In confirmation of this is the fact, among others, that forest-trees of a century's growth and more were killed by the high water of that year. Two other eras of very high water are reported by tradition, the one in 1814–'15, the other in 1788. Facts and comparisons reported render it nearly certain that at both these periods the levels attained to somewhere near the standard of 1838. At the former date much land and many buildings were submerged on the Detroit and St. Clair Rivers. Many statements also bear upon the fact of high-water periods between the several dates mentioned. Dr. Houghton relates, on the authority of Colonel Henry Whiting: "Old inhabitants agree that the water was very high in the years 1809 to 1802, roads along Detroit River being completely inundated, and even rendered impassable." And further, that in 1821 the river began to rise, "and in 1828 had again attained the elevation of 1815, submerging wharves that had been built in the interval; and it so remained until 1830."

As to low extremes, it seems well ascertained that the one of 1819–'20 was the lowest known prior to 1841—the low depression which succeeded the extreme elevation of 1838. Presumably it was the lowest known during the century. Old Frenchmen of Detroit had no tradition of a level below that of 1819. Statements regarding the stage of the water always make reference to the acknowledged highest and lowest years. Thus we are enabled to fix upon and determine with considerable exactness the relative values of other low periods. The water in 1796 was reported by lake captains to be universally low, and indicating a level five feet below the high extreme of 1838. From that year, they say, it rose rapidly, and continued to rise until 1800. Colonel Whittlesey says: "It was ascertained generally that the water was low in 1790, 1796, 1802, and 1810. Between February, 1819, and June, 1838, there was a continual rise, amounting to 6 feet 8 inches." Old settlers compare the low stage of 1802 with that of 1797. In 1806 it was reported at Cleveland lower than in 1801–'02, and declining regularly to 1809–'10. At this date it was reported nearly as low at Buffalo as in 1819. From 1828 it was reported as falling, and in 1833 was 3 feet 10 inches below June, 1838. From this year on we are able to trace the "secular" periods of lake and river with considerable accuracy; and data also exist in regard to other elements which it is proposed to include in our discussion. I give two diagrams, intended to exhibit graphically what is shown more in detail in the tables.

Diagram No. 1 shows the curve of high and low water of Lake Erie from 1788 to 1838, constructed in accordance with the above data. In connection with it is given the sun-spot curve, from 1769 to 1838, according to Wolf's tables, reference to which will be made hereafter. The lengths of the periods are also shown, and the lag of the lake periods behind the sun-spot periods.

Diagram No. 2 gives similar data for the term of years from 1834 to 1887, including, in addition to the curves of lake-levels, those of the rainfall and of the temperature (registered at Detroit), and of the sun-spots, according to Wolf's tables.

In these diagrams my endeavor has been to exhibit by curved lines the recurring maximum and minimum periods, eliminating intermediate and irregular fluctuations.

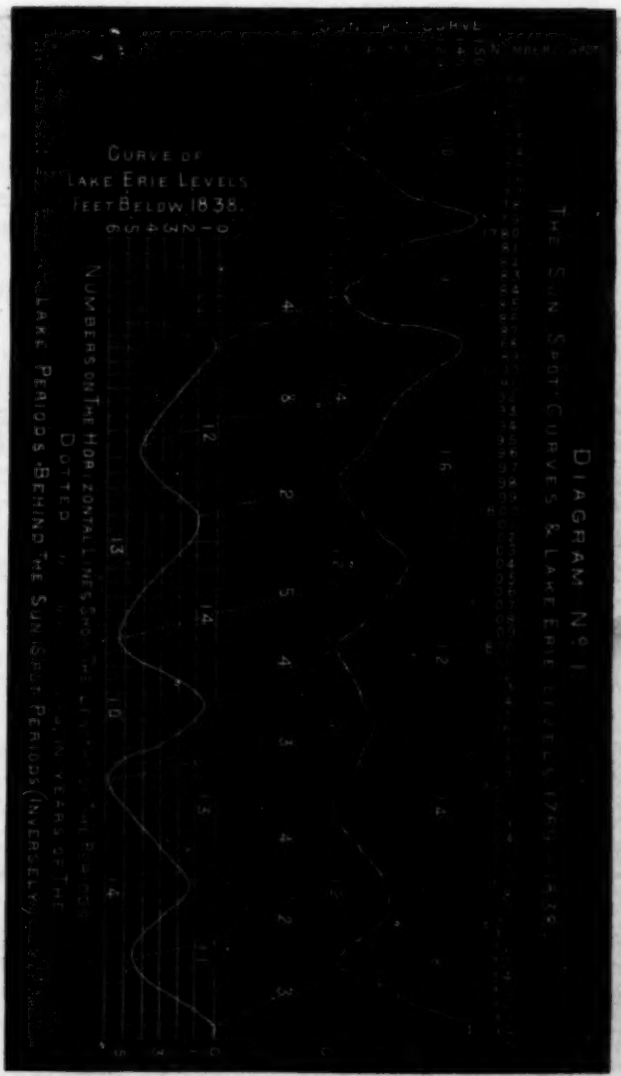
Confining our attention for the present to the curve of rainfall (Diagram No. 2), let us endeavor to ascertain whether among the many and often abrupt fluctuations it is possible to discover any periodicity.

The vertical columns represent years. In the portion devoted to the rainfall variations the horizontal lines represent the number of inches of annual precipitation.

It will be noted that the years 1836 and 1880 were times of excessive rainfall. Between these two extremes, and about equidistant,

appears another strongly marked period of excess, culminating in 1855. Again, between these three maxima are two lesser extremes, culminating in 1844 and 1868. Thus our curved line marks five periods of maximum rainfall.

Of low extremes we note four, which have their culminations in the years 1839, 1850, 1860, and 1872.

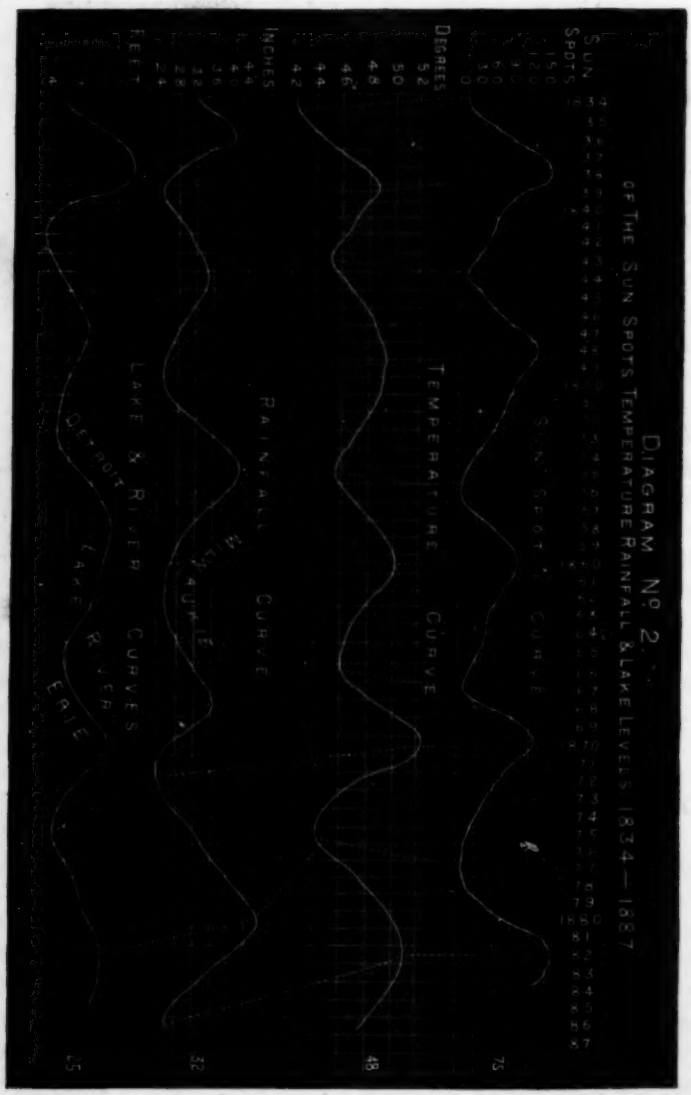

Curve of
Lake Erie Levels
Feet Below 1838.
Diagram No. I
The Sun Spot Curves & Lake Erie
Numbers on the Horizontal Lines
Dotted
Lake Periods Behind the Sun Spot Periods (Inversely)

The intervals between extremes vary from eight to fourteen years, the general mean being eleven years.

Let us now compare with these curves those immediately below, and which represent the periodic changes in the levels of Lake Erie during the half-century.

Here the horizontal lines represent the number of feet below the plane of 1838.

It requires but a glance at the diagram to show that some relationship exists between the lake and rainfall periods. The first impression conveyed is that the curves are in opposition—that the high in one corresponds with the low in the other, and the reverse. But I think



the true relation will be made to appear when we notice the important fact (which I endeavor to render more apparent by dotted lines), viz., that the water extremes lag behind the rainfall extremes—following them at intervals of from two to four years. Thus the seeming want

of coincidence is reduced to harmony. It will also appear that the rainfall extremes are not only followed invariably by corresponding fluctuations in the water-levels, but that these succeed each other in quite as marked and uniform periods.

The rainfall maxima of 1836, '44, '55, '68, and '80 have their corresponding extremes in the water maxima of 1838, '47, '58, '70, and '82—the intervals or lag varying from two to three years. The rainfall minima of 1839, '50, '60, '72, and '86 have corresponding lake minima in 1841, '53, '65, and '75—the intervals varying from two to five years. The mean lag is 2·9 years. The true relation—dependence—of the lake periodicities upon those of the rainfall is thus clearly shown.

It will be observed that I have chosen to consider the Lake Erie levels rather than those of Detroit River. I do so for the reason that the relations of the former to the precipitation are more simple and direct, and are not influenced by causes already pointed out (page 375), which tend to create irregularities in the river. A marked illustration is shown between the years 1859 and 1870—where dotted lines represent the rainfall at Milwaukee, and the river-levels as compared with those of Lake Erie—of the effect of excess of precipitation on the lakes above, in keeping up the river to a disproportionate extent.

I do not consider it necessary to examine the various theories which have been broached from time to time, in explanation of the lake periodical fluctuations. Nor will I undertake to explain all the irregularities of the river and lake, which would demand many factors that are wanting to the present discussion. It will suffice if I have succeeded in making clear the relations which exist between the variations of the water-levels and the rainfall, and in defining their periodicities. Probably few at this day would dispute the fact that the rise and fall, or "secular" variations, in the waters are dependent upon the rainfall. This is the first attempt, to my knowledge, at demonstration of their true relations.

Thus far I have not alluded to the important element of Temperature in its relation to rainfall. That an intimate relation exists is an admitted fact; it shall be my endeavor to show what this relation is.

In the portion of the diagram devoted to the Detroit temperature curve, the horizontal lines represent the degrees of mean annual temperature, which varies from 42°, the lowest, to 52°, the highest extreme. Considering temperature as a controlling element, we should expect to find a close correspondence between its curves and those of the rainfall. And we do so find, as is shown by the diagram. But, while the maxima and minima of the rainfall and the lake are directly as each other, we discover that those of the rainfall and the temperature are inverse to each other. For a full discussion of the relation between these two elements, no doubt we ought to take into account

other important factors—barometric changes, winds, magnetic and other phonomena. The conclusions of this paper are deduced only from the data presented. Let us now compare the curves.

The *maximum* temperature periods of 1839, '49, '60, '70, and '82 at Detroit will correspond to the *minimum* rainfall periods of 1839, '50, '60, '72, and '86—if we credit to the latter a lag or interval behind the temperature periods of 0 to 4 years. The *minimum* temperature periods of 1834, '43, '55, '66, and '75 correspond to the *maximum* rainfall years 1836, '44, '55, '68, and '80, with a lag varying from 0 to 5 years; the mean of the lag being 1·8 years.

If this showing reverses the commonly received opinion that high temperature is followed by extreme rainfall, I can only say that the facts, as I find them, do not warrant such conclusion. Let the reader attempt to connect either the maxima or the minima of the curve of temperature with the like periods of the rainfall, and he will find it necessary to admit intervals of from six to nine years, a conclusion which would be inconsistent with any influence whatever.

I now turn to another element, or phenomenon, which will be found to have an intimate bearing upon our investigation.

Recently, much speculation has been elicited by the ascertained periodicity of spots on the sun's disk. It is now an admitted fact that the increase and decrease of the spots affect the magnetic needle, and influence the earth's magnetic and electrical condition. The extent to which these affect the meteorology of our planet is a moot question with the learned on these subjects.

Some noted observers in Europe and India maintain the theory of an influence exerted by the sun-spots upon the rainfall, and this directly as the number of the spots. In this lake region, attempts to establish or define these relations have been few and unsatisfactory. It will be my part to show that the sun-spots do decidedly influence the temperature, and indirectly the rainfall, and that the curves of temperature correspond directly with those of the sun-spots. This correspondence holds not only as regards the maxima and minima periods, but as to the general features of the two curves.

Wolf's tables of the sun-spots from 1769 to 1882 show ten periods of maxima and as many of minima, the spots ranging from 0 in a minimum year to 150 in a maximum year. Of these periods, one half are embraced within the sixty-six years from 1769 to 1834. For this cycle there are no reliable statistics of temperature and rainfall; so that my data are confined to the sun-spots and the lake periods, of which I present a tabular statement, as supplementary to Diagram No. 1.

Table No. 1 exhibits in groups:

1. The years of maximum and minimum sun-spots from 1769 to 1834, according to Wolf's numbers—the maxima and minima in separate columns.

2. The years of maximum and minimum levels of Lake Erie, which are given in feet and tenths below the plane of 1838—the maxima and minima in separate columns.

3. The lag, or interval in time at which the periodic changes in the lake follow *inversely* those of the sun-spots. One column gives the number of years lag of the lake maxima behind the sun-spot minima; the other of the lake minima behind the sun maxima.

4. The sun and lake "*periods.*" In one column are given the number of years between each maximum of sun-spots and the next preceding maximum, and alternately, the number of years between each minimum of spots and the preceding minimum. In the other column are given the like data for the lake periods.

TABLE No. 1.

Maximum and Minimum Periods of Sun-Spots and Lake Erie, 1769–1834.

YEARS.	SUN-SPOTS.		LAKE ERIE LEVELS.				PERIODS.	
			Below 1838, feet and tenths.		Lag.			
	+ No.	— No.	Plus.	Minus.	Lake + behind Sun —.	Lake — behind Sun +.	Sun, years.	Lake, years.
1769	140							
1773	...	10						
1779	155	..	..	..	..	..	10	
1784	...	12	..	..	..	..	11	
1788	140	..	0·5	..	4	..	9	
1796	...	..	..	4·5	..	8		
1798	...	5	..	..	..	..	14	
1800	...	..	2	..	2	..	..	12
1804	85	..	..	..	..	..	16	
1809	...	..	..	5	..	5	..	13
1810	...	0	..	..	..	..	12	
1814	...	..	1	..	4	..	..	14
1816	55	..	..	..	..	..	12	
1819	...	..	..	6	..	3	..	10
1822	...	0	..	..	..	..	12	
1827	...	..	2	..	4	..	..	13
1830	75	..	..	..	..	..	14	
1833	...	..	..	3·5	..	2	..	14
1834	...	10						
Means	...	..	1·4	4·7	3·5	4·5	12·3	12.6

The phenomena which this table makes apparent are: First, that what I have called the *sun and lake periods* approximate in length, and the means of each are nearly identical—12·3 and 12·6 years. Second, that the sun and lake periods are not synchronous, but that the changes in the lake follow at considerable distance (lag) behind the sun-spot times. Also that the lake maxima lag behind the sun-spot minima less than do the lake minima behind the sun-spot maxima, the means being, respectively, 3·5 and 4·5 years. That is to say, the waters fall less rapidly than they rise, by the mean of a year. We

shall see presently how far these statements tally with the data drawn from fuller sources, for the half-century succeeding.

Let us now turn to Diagram No. 2, which exhibits the sun-spot curves from 1834 to 1884, paralleled with those of the temperature, the rainfall, and the lake.

We see five "periods" of sun-spot maxima, culminating in the years 1838, '48, '60, '70, and '82, the number of spots at each varying from 95 to 150. And five of sun-spot minima—in the years 1834, '44, '56, '67, and '77, the spots in each varying from 5 to 10. The maximum periods recur at intervals of ten to twelve years—and the minimum periods at like intervals—the means being 10·8 years. With the aid of the accompanying Table No. 2, we may proceed to compare results.

Table No. 2 aims to give in a succinct form all the data which our discussion requires. These are grouped in columns, as follows:

The first group gives (in three columns) the sun-spot data, in the same manner as in Table No. 1, viz., the years of maxima and minima, the number of spots at each, and the lengths of the periods.

The second or temperature group gives (in two columns) for those years of maxima and minima which conform to the sun-spot maxima and minima, the degrees of temperature (the mean of the year at Detroit), and the lengths of the periods.

The rainfall has three groups. The first gives for Detroit (in three columns) the maximum and minimum periods, the precipitation in inches at each, and the lag or interval at which each follows, inversely, behind those of the temperature. Like data are given for the rainfall at Milwaukee and at Cleveland, so far as I possess data, omitting the column of lag.

For the water-levels there are two groups, each showing (in three separate columns) the periodicities, the measurements in feet and tenths below the plane of 1838, and the lag behind the rainfall at Detroit.

Lastly are given (as in Table No. 1) the lag of the lake behind the sun-spot periods—lake maxima behind sun-spot minima, and the reverse.

My aim is to exhibit those fluctuations in the elements under discussion which conform to the sun-spot periodicities, according to the law which seems to govern, viz., temperature directly as the sun-spots; rainfall inversely as the temperature; lake-levels directly as the rainfall, and the periodical changes in each, following uniformly those of the preceding or influencing element by a lag of short interval; and this increasing in length according to the remoteness from the original source of influence.

When we consider that the sun is itself the ultimate source of all

our meteorological phenomena, the fact that the periods of greater and less energy indicated by spots on its disk have a well-marked relationship to the temperature and rainfall is not surprising. While there are many fluctuations for which no solution is attempted, it suffices if we are able to point out well-defined maxima and minima periodical fluctuations which conform to each other within small limitations.

The proof does not rest alone upon the Detroit observations. Though the rainfall at Milwaukee and Cleveland differs, often considerably, in times and amount, from the Detroit record, we find a close conformity in the periods. In fact, there is almost identity in the periodic means of all the elements contained in the table.

TABLE No. II.

Maximum and Minimum Periods of Sun-Spots, Temperature, Rainfall, and Water-Levels, 1834–1887.

YEARS.	SUN-SPOTS.		TEMP. DETROIT.		RAINFALL.						WATER-LEVELS.						LAKE ERIE LAG.	
					DETROIT.			MIL-WAUKEE.		CLEVE-LAND.		DETROIT RIVER			LAKE ERIE.			
	No. of spots.	Periods—years.	Degrees.	Periods.	Inches.	Periods.	Lag behind temperature.	Inches.	Periods.	Inches.	Periods.	Feet below 1883.	Periods.	Lag behind rainfall.	Feet below 1883.	Periods.	Lag behind rainfall.	Max. behind sun min.	Min. behind sun max.
1834....	10?	...	42?	12?														
1836....	...	...	....	....	40	..	2											
1838....	150	10	....	....	..	..	...	....	....	....	..	0	11?	2	0	11	2	4	
1839....	...	...	48·3	10?	24	8	0	25?											
1841....	...	...	....	....	..	..	...	....	....	....	..	4·5	9	2	4	9	3	...	3
1843....	...	...	45	9															
1844....	10	10	....	....	34	8	1												
1845....	...	...	....	....	..	..	...	....	....	....	..	1·5	7	1					
1847....	...	...	....	....	..	..	...	....	....	....	..	....	....	....	2	9	3	3·5	
1848....	125	10	....	....	..	..	...	33	11										
1849....	...	...	49·3	10															
1850....	...	...	....	....	26	11	1	26	11	....	..	3·5	9	0					
1853....	...	...	....	....	..	..	..	....	....	..	..	....	....	....	3	12	3	...	5
1855....	...	...	46	12	43	11	0												
1856....	5	12																	
1858....	...	...	....	....	..	..	...	45	10	44	10	0·5	13	3	1·2	11	3	3	
1860....	95	12	49	11	28	10	0	24	10										
1861....	...	...	....	....	..	..	...	....	....	32	11								
1865....	...	...	....	....	..	..	...	....	....	....	..	1	11	5	2·8	11	5	...	5
1866....	...	...	46	11															
1867....	9	11																	
1868....	...	...	..	....	36	13	2												
1869....	...	...	....	....	..	..	...	38	11										
1870....	132	10	52	10	..	..	...	....	....	47	12	1·4	12	2	1·6	12	2	3	
1872....	...	...	....	....	24	12	2	28	12	32	11								
1875....	...	...	44	10	..	..	...	....	....	....	..	2·5	10	3	3·5	10	3	...	5
1877....	5	10	....	....	..	..	...	....	....	52	8								
1880....	...	...	....	....	47	12	5	48?	11										
1882....	160	12	51	12	..	..	...	....	....	....	..	1·3	12	2	1·5	12	2	4	
1886....	...	...	....	....	25	14	4	....	....	26	14								
Means.	...	10·8	....	10·7	..	11	1·8	...	10·9	...	11	...	10·6	2·4	...	10·8	2·9	3·5	4·5

The two columns (on the right of the table) showing the lag of Lake Erie behind the sun-spots at each period, furnish a remarkable confirmation of the general conclusions. Comparing the two tables, it will be seen that the mean periodicity of the sun-spots is larger for the first half-century than for the last by 1·7 years. Yet the same relation to the lake periods is maintained throughout both cycles. The lag for the maxima and for the minima periods is the same in both tables, the means being 3·5 years and 4·5 years, respectively. This result is not merely remarkable ; it would be incomprehensible on any other theory than that here contended for. Its truth or fallacy the reader has the means of determining if he will closely study the details given in the table and the diagram.

Another feature of too much importance to escape attention is the difference in all the curves between the scales of increase and of decrease. This is shown by the diagram, and is computable from the tables. Thus, the times of increase in the sun-spot curve, from minima to maxima, are almost uniformly four years ; those of decrease, or from maxima to minima, six to eight years. The temperature curve attains its maxima at the same time or a year later than the sun-spots, but its minima are often reached a year earlier than those of the sun. The result is to nearly equalize the times of temperature increase and decrease, the rising scale being accomplished in 5, and the falling in 5·4 years.

The rainfall curves show a closer correspondence with the sun's times, but in reversed order, the rising scale being accomplished in about 6·5 years, the falling in about 4·5 years.

The lag of the lake curve behind the rainfall at its minima exceeds that of its maxima by nearly one and a half years (3·75 and 2·4). The tendency is to equalize the times of the lake increase and decrease, so that the "secular periods" exhibit nearly equal scales (5·4 and 5·25). During the cycle from 1779 to 1834 the scales differ more—rising 5·75 and falling 6·75 years. These are the closest correspondences I have been able to find to the traditional French period of 7 years.

Thus the cycle of change is "never ending, still beginning." On its restless sea, man is tossed at the caprice of billows, whose wave-lengths are intervals of eleven years. The law of change runs through the scale from cold to warm, and from warm to cold in nearly equal times, but demands half a year's less time in the descent from wet to dry ; while the upward scale, or from dry to wet, is longer by two years than the downward scale of temperature, and with intervals or lag of one and a half years.

To sum up, it seems to me demonstrated, as regards this region :

1. That the so-called "secular" changes in the levels of the river and lakes are dependent upon the rainfall.

2. That these changes in their maxima and minima fall behind the rainfall extremes in time, varying from two to five years.

3. That the times of maximum and minimum rainfall occur *inversely* as the temperature, and follow after, with mean intervals of one to four years.

4. That the times of maximum and minimum temperature occur *directly* as the sun-spots, with small or no intervals.

5. That the times of high and low water of the lakes and river follow behind the sun-spots, inversely, by a double lag—of lake behind rainfall and of rainfall behind sun-spots—the mean of both being four years.

6. That the periods of maximum and minimum sun-spots, temperature, and rainfall have an intimate relation to each other, and that this relation appears in the respective periodicities, which differ but little, while the means are nearly identical.

The question naturally arises, How far do the conclusions here recorded afford a foundation for forecasting the meteorology of the future?

If all the wave periods were of equal lengths and times, with sufficient allowance made for other factors not within our present discussion, we ought to do so with exactitude. But though our sovereign governor—the sun—exhibits a considerable degree of regularity in the increase and decrease of his spots, he has not as yet admitted us into the secret either of the cause or of the extent and frequency of his variations.

We have also seen that while the curves of temperature and rainfall are controlled by the sun-spot periods, their times of maxima and minima are not therefore synchronous. This is true to some extent as between the sun and the temperature, while those of the rainfall are not only inverse to, but lag behind, the temperature extremes, with varying times. There follows, therefore, a difference, both in the lengths and the times of the periodicities of each.* Owing to this lag, and its variation in time of one to four years, it follows that when the temperature curve is at its maximum or its minimum, that of the rainfall is not necessarily at its lowest or its highest. In fact, such a conjunction may be brought about in the progress of time, that a wet period may correspond in time to a warm one, or nearly so, and *vice versa*, and yet the law of opposites continue absolutely persistent.

This observation applies with even greater force to the lake curves, the lag in which is uniformly greater than in those of precipitation. Thus it has happened three times within the last half-century that high water in Lake Erie has corresponded in time with a high sun-spot period.

We observe, also, in noting the curves of temperature, as each approaches its low extreme, a sudden dropping of the temperature from

* While the periodic times in the curve of temperature range from nine to twelve ears, those of rainfall range from eight to fifteen.

a somewhat regular gradation, two to five degrees, during one, two, or three years. And in the approach to maxima a rise nearly as precipitate. This has its parallel in the rainfall—the precipitation experiencing a sudden increase in the high extremes of from eight to thirteen inches, and during low extremes of from four to eight inches, within one or two years.

In these records of the past century, imperfect as they are, will be found suggestions of more subtile and fundamental laws. The reader may notice a succession of three large sun-spot waves or periods followed by three lesser ones. They call to mind that succession of waves in the sea, called by sailors "the three sisters," and of the three-day weather period with which we are familiar. The conjecture may be warranted that we have here an indication of a major vibration of a six-period duration. It may be that all these cycles are but members of a grander whole, whose circles reach beyond our present ken, and to a perfect conception of which we may never attain, except perchance in that good time coming, when man's knowledge shall equal his aspirations. These considerations, and many more of which we are in ignorance, must enter into a calculation of the true horoscope of the future.

Nevertheless, we know that Nature governs by unvarying law. Assuming that her periodicities will bring about the same average results in the future as in the past half-century, I might undertake to be in some sort her interpreter of the coming events which cast their shadows before, along the pathway of a few unborn years; provided the same latitude be accorded me which was claimed by the old almanac-makers, to qualify the record with "about . . . these . . . days."

In each of our half-century cycles we have seen that there are five maxima and five minima of sun-spots, whose periodic times average for the first cycle a little more than eleven and a half years, and for the last cycle a little less. We may reasonably conclude that the next half-century will witness no material change, but that the like phenomena will continue, with a mean period of about eleven years; also, that the temperature and the rainfall will continue to exhibit their dependent phenomena as before. On this basis let us construct our diagram for the coming years.

Premising that the sun-spot curve, which for five years had been on the rising scale, attained its maximum in 1882, we may infer that the temperature is now on its descending grade, and should reach its minimum by 1889 or 1890. The yearly mean, which for ten years past has maintained an unusually high degree, with small range, will fall rapidly five degrees or more. "Look out for . . . cold . . . weather . . . about . . . these . . . years." The wary will also provide for cold winters about the years 1901, 1912, and 1923, and for epochs of high temperature about 1894, 1905, and 1917.

The rainfall, which, in accordance with its law of opposition and

of lag, fell in 1886 to the low measure of twenty-five inches, is likely to continue small for a year or more to come. "Expect a . . . period of drought . . . about . . . this . . . time." The increasing precipitation following should reach its maximum soon after the beginning of the last cycle of the century. Maxima, or wet periods, may also be predicated for the years 1903 or '04, 1913 and '14, and 1924 or '25; and low, or dry periods, for 1895 or '96, 1909 and 1919 or '20, or 'thereabouts.'"

Following these leads, lake and river levels will rise to their culminations, it is probable, about 1894, 1906, 1916, and 1927 or '28, and fall to low levels about 1888 or '89, 1899, 1912 or '13, and 1921 or '22.

None need be surprised if the remaining years of the century witness disasters to the husbandman from drought and frosts, and to the business man from commercial disasters and stagnation in trade.

The new century, though opening with cold and wet, gives promise, in its first cycle, of returning general prosperity, inaugurated by abundant crops, and—if the nation be wise—by freer trade, restored commerce, satisfied wages, and solid wealth. Blessed be the sun-spots!

ENGLISH PHONOLOGY.

By THEO. H. KELLOGG, M. D.

LANGUAGES, like nations, have their growth and decay. Their evolutionary phases have, in many instances, after much learned research been clearly traced. A living language, however complete a development it may have attained, never preserves for any great length of time precisely the same grammatical structure or phonetic character, but it undergoes constant changes both of form and of sound.

The formative stages are usually attended by the most active organic alterations, and the decided mutations of the old, middle, and modern English periods are familiar to the linguistic student.

Within the last century, however, there have been no like radical changes in the English tongue, although many terms and phrases have become obsolete, and hosts of new words and expressions, chiefly technical and scientific, have been added. This permanency in the outer forms of the language has favored a greater uniformity in its elementary sounds. In England, at the present time, apart from the dialects confined chiefly to the ignorant in the various shires, and overlooking the slightly individual variations such as have existed at all times and in all languages, there may be said to be a uniform pronunciation of the mother-tongue among the educated classes. Even slight departures from this generally accepted orthoëpical standard, especially if they occur in the original elements of the language, strike the ear in an unfamiliar way like the sounds of a foreign

tongue. Such departures have always arisen among colonists long and widely separated from the mother-country. It would be a contradiction, therefore, of all historical precedents in this regard if any American, native of the second generation, and bred in the United States, were to speak English, or any other modern language, with absolutely the same phonetic effect as a native of the mother-country. It is an undoubted fact that decided differences of English pronunciation exist between the educated classes in England and in the United States, and it is the object of this article to show in what these differences consist.

A careful comparative study of British and American English reveals the important fact that the phonetic differences are not confined to timbre of voice, or to accent and inflections, but that they are of a more radical nature, and are to be found in the component vowel-sounds themselves. It is not within the limits of this article to take into comparative consideration the broad subject of the various accents and dialectic peculiarities which exist in various parts of the United States and England, but it is intended to confine this phonological analysis to such patent differences of speech as prevail between educated Englishmen and the great mass of the more intelligent natives of this country. As social and business ties between the two countries are becoming constantly stronger and more direct, attention is more frequently drawn to these existing inconsistencies of utterance. Some Americans have in a measure modified their pronunciation to accord with English usage, and some of our actors especially have been at no small pains to reform their speech in accordance with the English standard which has come to prevail in the principal theatres of this country.

It would greatly facilitate the analysis here undertaken if there were some universal alphabet of the elementary sounds of all languages into which a translation could be made of such special modifications of vocal elements as are to be described. The nearest approach to such a universal alphabet is the one invented by Alexander M. Bell, and now successfully employed in the instruction of deaf mutes, but as it is only known to comparatively few the more ordinary terms of orthoëpists will be used.

The subject will be presented in the following order :

1. Differences in vowel and diphthongal sounds.
2. Differences in the consonants.
3. Differences of syllabic accent.
4. Differences of emphasis, inflections, and vocal timbre.

The subdivisions under these heads will be as far as practicable in alphabetical order.

Differences in Vowels and Diphthongs.—First in the order of the vowels there are the various sounds of the letter *a*, which furnish some of the most typical instances of the departures of the American

from the customary English pronunciation. The open sound of *a* in the word father is known as Italian *a*, and it was until the beginning of the present century in almost universal use in England, in a certain class of words in which Walker, and other lexicographers influenced by him, substituted short *a*, as in hat. The short *a* never became popular, and it was regarded by many as a species of learned affection, and in these words at the present day the open Italian *a* is very generally used in England. In the United States, on the contrary, the short *a* has come to be the sound employed by the vast majority of both the learned and less-educated classes in these instances. This sound of *a* occurs in a large class of words, such as last, past, after, ask, etc., and unfortunately it is not the explosive short *a* in hat as recommended by Walker, but a more prolonged and flattened sound, as it is uttered by most Americans, and one not authorized by any lexicographer. Fulton and Knight, and subsequently Webster, advised in this class of words a shortened sound of Italian *a*. Their intention, which was that this sound should differ in quantity only and not in quality from the Italian *a*, seems to have been misapprehended by certain cultivated speakers who, not satisfied with the flat *a* of common speech in this country, have adopted a sound intermediate in quality between short and Italian *a*. No such intermediate sound is ever uttered by native Englishmen. In the schools and universities, at the bar, in the pulpit, and on the stage, among officers of the army and navy, and among the learned and ignorant alike, the prevailing sound heard in these words in England is the open Italian *a*. It is not to be overlooked that a minority of New Englanders and a few Southerners have preserved this native English sound in this class of words.

But there is another series of words, like bath, aunt, half, path, calm, palm, etc., in which Americans depart still further from English usage by the employment of the flattened and prolonged *a* above mentioned. Now, it is needless to say that not only all English precedents but all lexicographers, American as well as British, demand the use of the full Italian *a* in these words; for, though there may be a choice of the short *a* of Walker, or of the open *a* in the first class of terms, there is absolutely no option in this instance. Helmholtz long ago proved that this Italian *a* has more harmonic overtones than any other vowel, and it is unfortunate that this most sonorous and musical sound should have so largely disappeared from English as spoken in the United States.

Another kind of *a*, known as long *a*, as in the word fate, is in reality like most of the vowels, of a composite nature, consisting of a fundamental and initial sound somewhat less open than Italian *a*, and a vanish in *e* long. This initial element is more open, and the diphthongal nature of *a* long more evident in the English than in the American pronunciation. This difference of utterance may be detected in a great many positions of long *a*, but especially in words

like day, pay, etc., in which *y* represents the vanishing sound of the vowel. The long sound of this vowel in the article *a* before words beginning with a consonant—e. g., a man, a book, etc.—instead of the short and obscure sound, is also very common in the United States, but seldom heard in England.

Again, *a* before *r*, in such words as care, rare, and in many like positions, is also a double sound, with a primary vocal element resembling short *a*, and a final one, like *a* in are, according to some writers. This final element is more open as given by Englishmen, and approaches nearly Italian *a*, and the *r* is so slightly sounded, even by correct speakers, that in the mouths of many it probably has no organic formation, and thus corresponds to the provincial pronunciation given by some Southerners to the final syllable of words like door, drawer, etc., in which the open *a*, as in ah, is heard. As pronounced by most Americans, the final sound in these words is ur, and the final *r* has a real value, of which further mention will be made under the head of this letter. A few New Englanders and Southerners differ but little from the English usage, either with radical or terminational elements of *a* in the above instances.

A, as in walk, water, awe, fall, etc., is produced with a deeper and broader sound by Englishmen than by Americans. Some of the latter, in fact, pronounce such words so that they have more nearly the sound of short *o* than the deeply-formed vowel which issues from native British throats, and which is more profoundly formed than the German gutturals.

There is a corresponding difference, also, in the open and brief sound of *a* in what, wash, wallow, was, and in other words in which *a* has the value of *o* in odd.

The varieties of the vowel *e* also illustrate well the phonological differences of the vernacular of the two countries. The sound of accented *e* before *r*, not followed by a vowel or another *r*, as in her, term, mercy, etc., is that of *u* in fur, as uttered by most Americans, but English speakers give it a less guttural and more open sound, verging toward *a* in are, which sound is fully heard in a few instances as in clerk, pronounced clark in England. The correct sound between *u* in fur and *e* in met is only formed by the minority of speakers in this country.

The American long *e*, as in evil, is produced by a closer approximation of the tongue to the palate. The English name-sound of this *e* has less firmly closed lingual points of lateral contact.

The short *e*, as in met, contrary to American custom, resembles somewhat in quality long *a* as pronounced by many Englishmen. The latter always give a brief and obscure sound to *e* in the definite article before words beginning with a consonant, as the man, the book, etc., but in this country long *e* is often heard in these instances.

The long *i* in ice, shine, time, find, etc., like most vowels, is a pho-

netic compound, and it has Italian *a* as the radical and long *e* as the vanish, and the American transition from the former to the latter is quicker. The English *i* is more diphthongal and the radical element is a more open sound. In fact, this distinctly audible separation of the pharyngeal and lingual modifications of the vowel elements constitutes an important point in the comparative phonology of British and American English.

For the relative differences in *i* before *r* in accented syllables, as in virgin, third, etc., reference is made to the above description of *e* under like circumstances.

Short *i*, as in pin, as the equivalent of *y* final in beauty, badly, philosophy, etc., is the usual pronunciation in the United States, but British usage is a sound like *a* in quality, but more nearly identical with the open *e* (*e ouvert*) of the French. In fact, the frequent recurrence of this sound in English mouths at the present day is probably a relic of the influence of Norman French upon the Anglo-Saxon vernacular. The short *i* in pin has in American articulation its correct shut and explosive sound, such as exists in few other languages, but it more closely approaches long *e* in quality in British usage.

The long sound of *o*, as in home, bone, etc., has an initial element, formed more deeply in the throat than Italian *a* with a slight vanish in *oo*. The American differs from the English pronunciation in two ways—first, in that the labial modification is more decided with lips more nearly approximated ; and, secondly, in that the secondary element is omitted, and the *o* approaches short *u* among many New Englanders, as in stone, home, broke, spoke, whole, and many similar words. In most Americans, however, the difference is in the labial modification alone, and if the lower jaw is allowed to drop slightly in the articulation of the word blow, for instance, the long *o* with the enlarged labial aperture becomes almost identical with the native English sound of the same letter. On the other hand, there is in England a cockney and provincial separation of the posteriorly and anteriorly formed elements of this vowel which is not to be found among natives of the United States.

The short *o*, as in hot, odd, cot, etc., is formed by Englishmen with more laryngeal depression and greater posterior oral enlargement. The American short *o* issues from a less deep throat-formation, is not as broad, and is usually a less abrupt sound. The long sound of double *o* as in food, moon, etc., is one of the extremes of the scale of vowel elements, and it is uttered by Americans with greater labial contraction than is customary among Englishmen. New Englanders are wont to substitute for it the short sound of *oo* in foot, in words like broom, roof, root, and in a large number of similar words. British custom always retains the long double *o* in these instances. There is a British fault in Yorkshire and other northern parts of giving the long instead of the short double *o* in cook, book, etc., for although

Walker favored this pronunciation all good usage at present is opposed to it.

The name of the letter *u* consists of a double sound of which the first element is *y* or *e*, and the second is long *oo*. This compound nature of the vowel *u* is more generally marked in English than in American pronunciation. The most careful speakers are equally correct in the orthoëpy of this letter, but the majority of Americans substitute simply the long *oo* in words like tune, duty, Tuesday, nude, suit, etc. Some Southerners, however, fall into the opposite error, and give the initial element of this vowel undue distinctness.

In the short *u*, as in tub, sun, fun, etc., there is also a very perceptible difference between the pronunciation of the two peoples. The American sound comes forth naturally without any active oral adjustment—is similar to the *u* in furl, and is very much like that which is known as the neutral vowel. The English sound is shorter, more open, and is attended by a pharyngeal opening effort which is wanting in the American utterance. Similar corresponding differences obtain in a numerous class of words like hurry, flurry, etc., in which short *u* precedes the letter *r*.

The above are the chief phonological dissimilarities in the vowel scale, and attention is now asked to a few diphthongs. In the words boy, oil, join, etc., the diphthong *oi* is compounded of broad *a*, for the initial and short *i* for the terminational element. In English speech the broad *a* receives the full and decided stress of voice, and the final element is very brief, and the transition from the former to the latter is instantaneous. In American utterance the first element is dwelt upon, and the passage to the final one is less direct.

There is a want of agreement in the diphthong *ou*, in out, now, house, etc., as pronounced by Americans and Englishmen. Some of the former interpose between the vocal constituents of this diphthong a species of neutral vowel, while others use a much less open sound than Italian *a*, as the radical element. The latter fault is not confined to this country, however, but is equally a cockney peculiarity.

The chief points of phonetic variance in the consonants must now receive some notice.

Differences in the Consonants.—It is well known that Englishmen "drop their h's," as they express it. To be sure this practice is more common among the lower classes, but even among the highly educated, either through inadvertence or the force of early habit, this gross error occasionally occurs. The more ignorant, as if determined to be at cross-purposes with this letter, not only omit it from syllables in which it should be sounded, but they prefix it to words beginning with a vowel. Natives of the United States are singularly free from these erroneous practices.

The letter *r*, which is of such phonological importance in modern languages, has many divergent phases in British and American

English. The lingual or trilled *r* is properly used when this letter begins a word, e. g., round, rattle—when it is one of two initial consonants, e. g., proud, stream, and when it is between two vowels, as in spirit, orange, etc. In general this rough *r* is more distinctly trilled by Englishmen than by Americans, and their vibration is formed more anteriorly with a touch of the tip of the tongue against the hard palate. This vibration is very brief except in the most formal oratorical efforts, and it should be simply a double contact and never a distinct roll as given by the Scotch and Irish. *R* final or before a consonant, as in bar, born, has a guttural vibration in American utterance, but it is so smooth in English usage that the question has been raised by some orthoëpists whether it has any real value in these words or after a long vowel in the same syllable as in here, fire, our, and in many similar words. Whatever sound the obscure *r* may have in these instances is by Englishmen joined immediately to the preceding vowel or diphthong, but most Americans interpose between the previous vowel and the *r* a species of neutral vowel like *u* in urge, and slightly stiffening the tongue and raising the tip a little toward the dental arch they produce not a true dental *r* but a peculiar guttural *r*, which is in general use in the United States, except among some New Englanders and Southerners whose usage accords more exactly with the native English sound.

The writer's views of the English varieties of the letter *r* were published some years ago in England,* and a satisfactory physiological explanation of the soft *r* was then offered. In certain positions *r* has such slight value that some orthoëpists have regarded ah and are, for example, as identical in sound, while others, not admitting this view, have given no anatomical distinctions or rational theory as to this *r*. The original view advanced and still held by the writer is that the essential organic formation of this soft *r* is laryngeal, and consists in the tension and approximation of the true vocal ligaments so as to produce a friction-sound of the escaping breath. The breath thus roughened in its passage through the rima glottidis is the true basis of this *r*, which in some speakers receives a little additional value from slight pharyngeal constriction. Various analogies support this view of the organic nature of soft *r*, for several rough sounds are produced by the contraction of the "cordæ vocales" to a degree not productive of vocalization. The "spiritus asper" of the Greeks was thus produced. The fricative quality of our own *h* has a similar origin, and there is an obscure Teutonic *r* best heard among the Saxons having a like organic formation.

In July, 1878, the writer gave a written description of the English uvular and labial *r*'s. The former is the basis of what is popularly known in England as the Northumberland burr, and it corresponds to the uvular *r* of the Germans, and to the *r* "*grasseyé*" of the French.

* Professor Plumptre's, "King's College Lectures on Elocution," London, 1881.

If this *r* is produced skillfully by the vibration of the uvula alone it is to be distinguished from the lingual *r* only by a practiced ear, but if as in Swiss, German, and certain Gallic dialects, the pillars of the soft palate take an active part in its formation, it acquires a very harsh and disagreeable character. The substitution of *w* for *r*, by which real becomes weal, great, gweat, etc., is so far as personally observed English and not American. It is also probable that the use of *w* for *v*, as weal for veal, wery for very, is cockney, and never heard in the United States.

Did space permit much might be added to this description of the more patent differences of the elementary sounds of the mother-tongue as spoken by Americans and Englishmen, but syllabic accent, inflections, and vocal timbre also claim some attention.

Accent.—In all English words there is one syllable which receives greater stress of voice than the others. In words of two syllables the accent falls on the first one, and in polysyllabic words on the antepenult. The exception to this rule and the general laws of accent can not receive any notice here, but it is to be kept in mind that nothing more decidedly alters the phonetic character of English than changes in syllabic accent. A good pronunciation is distinguished by a firm and prompt attack of the accented syllables which are like the emphasized notes of a song, and they sustain the rhythmical flow of speech.

Apart from the primary accent there is a secondary and tertiary one laid on other relatively less emphatic syllables, and in the misuse of these is to be found one American peculiarity. In general, Englishmen have a more emphatic and superior delivery of the primary accent, but they are more wont to slur over the remaining syllables. This gulping of long words is offset by an opposite and equally great defect among Americans, who sometimes give the secondary accent in many words almost the same force as the primary, and their speech thus becomes drawling. Instead of giving one they employ a double decided accent as here marked in mil'ita'ry, mat'rimo'ny, ter'rito'ry, cir'cumstan'ces, and also in words of fewer syllables there is a like fault as in gi'gan'tic, im'men'se, rhu'barb, and a great many similar instances in which there should be a strong primary, and a very light secondary accent. To a native English ear this slow division and double accentuation of words is one of the most striking of the many peculiarities of American English.

Emphasis, Inflections, and Vocal Timbre.—For the learned the above orthoëpical differences are all important, but for the great mass of the people the vocal qualities embraced under the present heading constitute the most striking distinctions which the unpracticed ear recognizes between the vernacular of the two countries. Even the child without knowledge or thought of correct pronunciation is struck by the foreign tone of voice and the novel inflections. The American in London, though he may assume the dress and manners of the people,

is immediately recognized by his speech, just as a Londoner in New York betrays his nativity by the first sentence which he utters. The facts under this heading are not fully within the limits of science, as they have not been classified by any definite laws, but they are sufficiently understood to afford some general grounds for comparison.

Emphasis is the stress laid upon particular words in a sentence, and it is to phrases what syllabic accent is to words. Englishmen excel in emphasis in common conversation, but they are less successful in its use in public speaking, whereas Americans seem to require the stimulas of public occasions for effectual delivery. The shifting of the emphasis from one word to another alters the entire meaning of sentences, and it has been even claimed by some that all who conceive a like meaning must make a like use of emphasis. This is a mistake, however, and the writer has convinced himself that there are actual differences in the employment of emphasis between Englishmen and Americans, but to discuss it would involve the natural rhythmical division of sentences—the laws of poise of voice and other lengthy subjects.

The rising, falling, and circumflex inflections express interrogation, affirmation, denial, and many shades of meaning and of feeling, and they always have a wider range when the emotions are deeply stirred. Englishmen use more inflections than Americans, and both in conversation and in sustained oratorical efforts they resort more constantly to the rising inflection. Even the most careless listener will be impressed with this fact. Their voice is modulated from the middle to the upper register very frequently, the conversational pitch is higher, and the grave monotone so common in this country is seldom to be heard.

The emotional modulations in different keys are more common in English conversation, and little children with plaintive appeals in minor keys, and also in their exultant moods most effectually express feeling by vocal modulation.

Finally, there is a physiological difference between Americans and Englishmen in the organs of speech due to changed climatic and other physical conditions of life. That the inherent quality of voice which characterizes different nationalities is due in part to differences of telluric and meteorological influences as well as to diversity of race and language can not be doubted. Instructors in vocal music know the various foreign voices and the effects of locality and climate in this regard. Vocal timbre, then, is a fundamental quality of voice distinct from syllabic accent, oral adjustments, emphasis, or inflections, and it is dependent in part on the individual's physical environment.

The English timbre of voice is generally harder and clearer than the American. It has been said that throat-troubles and pharyngeal relaxation are more common in this country, but reliable data are wanting to prove this The nasal tone so common in the United States

is due exceptionally to uvular relaxation, and it is more frequently a bad habit which it is difficult for the possessor to recognize or to correct. Nasal intonation also has unfortunately grown to be an emotional modulation among Americans who unwittingly employ it in moments of embarrassment or indecision, and also when expressing religious emotion and various other feelings. Fortunately Americans are relatively free from the various kinds of stammering and affected hesitancy of speech so often heard in England.

The practical conclusions to be drawn from all of the above facts are briefly as follows:

1. That in keeping with the logic of past events in other languages American English, in a new physical and moral environment, has undergone a radical modification of vocal type.

2. That Americans can not be expected to conform to British customs so far as mere emphasis, inflections, and timbre of voice are concerned.

3. There are cogent reasons for efforts to keep the fundamental sounds of the language alike in the two countries, and it is the duty of all educated persons to correct such provincial or unauthorized utterances of the vowel-sounds as have been here described, and to strive to preserve the purity of the mother-tongue. If this article shall serve to awaken an interest in this important subject, or to aid any in its study its object will have been fulfilled.

THE MONKEYS OF DUTCH GUIANA.

By AUGUST KAPPLER.

THERE are eight species of apes in Dutch Guiana. The most conspicuous of them is the howling ape (*Mycetes seniculus*), which is also one of the best-known and largest of the race. It is called a baboon in the colony, *alouatte* by the Caribs, and *itoli* by the Arowaks. When standing up it is about three feet high, and weighs about twenty pounds. It lives in both the coast-regions and the interior, and eats fruits, leaves, and buds. Its big, scantily-haired belly, the thick, tawny skin of its back, passing into a purple-brown at the back of the head and the feet; its black face, with its strong set of teeth, and the prominence under its neck, covered with a long yellow beard, altogether make it one of the ugliest apes of tropical America. It lives in small troops of rarely more than twelve individuals, among which is always to be found an old, full-grown male, which takes a higher place on the tree than the others, and leads the lugubrious concert by which these apes are so broadly distinguished from other species. The windpipe of the male is much stronger and more complicated than that of any of the other apes, and is connected with a vocal apparatus

composed of bone-substance of about the size of a goose-egg, which is set in the hollow of the under jaw. It looks from without like a wen, and acts as a sounding-board to strengthen the voice to an almost incredible extent. The females have a similar apparatus, but only about an inch in size. I do not know what it is that prompts the animal to set up its great cry. It is believed in the colony that it cries out only when the flood-tide begins, but this is wrong, for these apes howl at all times of day, and quite as much in the interior of the country, where there can be no tide. There may be some atmospheric influence which provokes the males to howl, while the females join in with them. There can not be a sexual impulse in the matter, for that would not make old and young howl together. I have had opportunities to hear this howling a great many times, and to observe the howlers from a very close vicinity. Every time, there sat an old male up in a tree, supporting himself on his fore-feet, and having his long tail, naked of hair on the inside for about nine inches from the end, black and smooth as a hand, wrapped around a limb, while other males, females, and young sat beneath him in a variety of positions. All at once the old fellow would set up a horrible rattling "Rochu, rochu!" which, after five or six repetitions, passed into a bellowing in which all the others would join, and which was loud enough to make one afraid of losing his hearing. It is so loud that it can be heard on still nights two leagues off; and it lasts for about ten minutes, and then subsides. The roar of the tigers, which troubled Pichegru and his companions so much on their flight from Cayenne to Surinam, was evidently nothing else than the howling of these apes, which might well fill one, hearing it for the first time, and not knowing that it came from harmless monkeys, with fright. The howling ape is sluggish and melancholy, and jumps only when it is pursued, while at other times it climbs deliberately among the trees, always holding itself by the tail. When captured young it becomes tame and confiding, and will play with cats and dogs, but is usually quiet, and if the person to whom it is attached goes away, it indulges in a continual rattling and highly unpleasant cry.

I could never succeed in raising one of them. They have a peculiarly unpleasant odor, by which one can easily tell when he is near one. Like all the apes, they bring only one young into the world at a time. Their principal enemy is the tufted eagle (*Falco destructor*).

The *quatta* (*Ateles paniscus*) is as large as the howling ape, but slimmer and not so slow. It does not appear on the coast, but only in the higher lands, where it constitutes a choice game for the bush negroes. Its head, body, tail, and feet are clothed in bright black hairs, while its nearly bare, narrow, ruddy face is very like that of an old Indian woman. The tail, about three feet long, is, like the tail of the alouatte, bare on the under side for about nine inches. The tip of the tail is also the animal's most delicate organ of feeling, and commonly

answers to it the purpose of a hand. Wherever the monkey goes or climbs, that member is its support and its aid in climbing. If these apes are observed climbing, it is hard to tell what is tail and what foot; and they have been very aptly called spider-apes, because when they are hanging in the limbs they look like a big spider. They become very tame, but are much less lively and charming than the capuchin apes. They live on plants alone, and eat buds very readily, but never insects. While of the howling apes mostly males are shot, among the quattas the females appear to be more numerous. Their tails being tightly wrapped around the limbs, they do not fall from the trees when shot, but hang to them, sometimes till putrefaction sets in. For this reason the Indians of the interior shoot them with arrows that have been poisoned with the *woura*, the effect of which is to relax or paralyze the muscles, and insure a speedy fall of the animal.

The most docile of all the apes of Guiana, and the one that is most frequently taken to Europe, is the capuchin ape (*Cebus appella*). It is called *kesi-kesi* in Surinam, *macaque* in Cayenne, *meku* by the Caribs, and *pfuiti* by the Arowaks. It appears in pairs, or in troops of not more than thirty individuals, among whom are always some old males, with hair standing out from their foreheads, as if the animals had little horns. Their color is a dark olive-brown, a little lighter in the face. Their hands, feet, and hairy, winding tail are nearly black. They are about the size of a cat. They are very shy, and take quickly to flight whenever they perceive anything wrong. They have a peculiar flute-like call and whimper, which the Indians, having learned to imitate very deceptively, make a means of decoying them to be shot. They can often be heard in the woods, beating down nuts or conversing with one another. They live on fruit, birds' eggs, and perhaps young birds, too, but do not eat leaves or insects. If caught young they soon become tame, are very interesting, and attach themselves to those who treat them well, with a patient affection which they manifest by caresses and tears. They are very fond of tobacco-smoke, and take great delight in rubbing their bodies with "the weed." There are several varieties of the capuchin ape. A light-colored, very docile kind (*Cebus fatuellus*) is more abundant in the interior of the country. There are more males than females in this species.

The *Pithecia Satanas*, a handsome ape, living only in the mountainous interior, resembles the former species in figure, but is somewhat smaller, and has a bushy tail which hangs straight down. The Indians call it *hiu*. It is rare, and I only knew of one specimen that lived for a few years in a tamed condition. Its back is yellowish brown, its face black, and its head, feet, and tail dark brown. It lives in small families of five or six individuals, and is not very active or hard to catch. I had a young female on the Maroni, but it soon died. I also had a male that had been shot and had recovered, but it never became tame, and died on board the vessel that was taking it to Amsterdam.

The remarkable feature of this ape is its beautiful hair and beard. The dense head-hair of the male is divided in the middle of the forehead into a thick beard about two inches long, running down the cheeks and under the chin from one ear to the other. No beau could keep his beard and hair in better order than this handsome animal.

The prettiest of the apes of Surinam is the squirrel-ape (*Chrysobryx sciurea*). It is called the monkey in the colony, *sapajou* in Cayenne, *akalima* by the Caribs, and *cabreanama* by the Arowaks. I kept three of these little monkeys at a time for twenty-six years; and as soon as one died, I took care that another should come in its place. One of them lived thirteen years in captivity. They are considerably larger than a squirrel; the body is about twelve inches long, colored greenish-gray with a white belly; the fore and hind legs are golden yellow, face and ears white, snout black, and eyes large and brown. The hairy, soft tail is black at the tip and a little longer than the body, and serves the animal as a kind of balancing-pole when he takes his jumps. In sleep and at rest the tail is slung over the shoulders. These apes are very lively, always in motion, although they sleep through the day, and are extremely sensitive to cold. They lie much in the sun; and, if one would have them live in Europe, they must be kept constantly in a temperature of not less than 75°. They usually live in large troops of a hundred and more, not in the deep woods, but in the shrubbery on the borders of the woods, and support themselves on fruits, insects, and birds' eggs. I always got them quite young, and they soon accustomed themselves to milk, bread, and ripe bananas, on which they thrived well. When at first they were allowed to run around loose in the room, they would suck their thumbs like a child for hours at a time. Their clean, white faces, with the hair-line sharply defined, their black mouths, large, lively eyes, and their sprightly, confident behavior gained them everybody's liking. Although they were easily enraged, they would soon return to a good humor; and in most ways they behaved very much like little children. They never tried to bite unless they were irritated, and under good treatment were as harmless, pleasant creatures as one could find. They were kept tied under the galleries of my house, and at night were shut up in a kennel together, for they could not be allowed to run about in the house after they grew up, because they handled and spoiled everything. If they were allowed to run at large, they would attach themselves to the swine, and run around with them through the meadows. At five o'clock every evening, after the shutters had been closed, they were let loose, and had a mad chase among the bread-fruit and palm trees, which lasted till it grew dark, when they came of themselves to be shut up in their kennel. While they ate insects, they did not seem to know how to distinguish the poisonous ones; and three of them died from eating the wrong butterflies. We were indebted to these little animals for much entertainment in our solitude on the Maroni.

These apes are not docile, and, notwithstanding their comparatively large foreheads, they are far beneath the capuchin apes in intelligence. When they feel well, they purr like a cat; when frightened, they utter a sharp, shrill, palatal sound; if angry, they scream like a magpie. They were usually brought to me from the sea-shore, where they used to sport in the most lively manner among the awarra palms, never seeming to mind the long, sharp thorns with which these trees are covered. The Indians shoot the mothers while they are carrying the young on their backs, or else they shake the young from the trees after the mothers have set them down. Males are rarely taken, but nearly all that are caught are females.

I had at several times specimens of another pretty ape, the *manaku* (*Pithecia leucocephala*), called by the French *maman dinan*, and *arighi* by the Caribs. It is not larger than the squirrel-ape, but seems to be twice as thick, on account of its long hair. The male is dark-gray and covered with long hair, with a hairy and bushy tail about ten inches long. The light-yellowish, hairy face looks like a mask, beneath which the black nose and the mouth are strongly marked. The female is brownish. This monkey is easily tamed, but is always shy and melancholy. It lives in troops of not more than ten members, in the deep woods. It is quite rare.

These eight monkeys are the only species that live in Dutch Guiana, no others being known, even to the Indians. Such broad streams as the Amazon, Orinoco, and Rio Negro seem to make a separation between species, so that mammalia, even when the plant-life is alike on both sides, are wanting on one side of the waters while they are common on the other side.—*Translated for the Popular Science Monthly from Das Ausland.*

SKETCH OF CLEVELAND ABBE.

THE name of Cleveland Abbe is especially associated with the installation of the meteorological service and weather forecasts of the United States Signal Service, and he has been prominently active in the movement to establish a uniform standard of time for the American continent, which should also be in conformity with the standards of other nations.

Professor ABBE was born in New York city, December 3, 1838. He is a son of the late George Waldo Abbe, who was for many years prominent in the business life of New York, and closely identified with its principal charitable organizations. He received his academical education at the New York Free Academy, now College of the City of New York, where he made a most honorable record for diligence and fidelity in his studies, or to use the words of one of his classmates, as "a young man who was interested in his work, and anxious to learn.

As he went through college his ability in mathematical and mathematico-physical science became more and more apparent, and, at the close of the college course, there could be no question of his superiority." Having been graduated from this institution in 1857, he taught mathematics in Trinity Latin School for one year, and afterward connected himself with the University of Michigan, where he served as teacher of the higher mathematics in the Scientific School, and studied astronomy under Professor Brünnow. Thence he removed, in 1860, to Cambridge, Massachusetts, where he spent four years in association with Dr. B. A. Gould, and was engaged upon the telegraphic longitude work of the United States Coast Survey. In continuance of his astronomical work, he resided for the two years, 1865–'66, at the Observatory of Poulkova, in Russia, which was then under the direction of the illustrious Otto Struve, in the position of supernumerary astronomer, as those young persons not military officers are called, who are allowed by the statutes of the institution to reside within its precincts for their own advantage. Generally, according to Mr. Abbe's account of the observatories at "Dorpat and Poulkova," which is given in the report of the Smithsonian Institution for 1867, "these inevitably contribute something to the furtherance of the scientific work of the observatory, while receiving from it the treatment of guests. The new statutes allow the director to give these young men a position and rank as civilians serving the observatory, but not in the service of the state; thus they may be properly considered as supernumerary astronomers, who, however, enjoy some of the privileges of such as are permanently in the state service, which is no mean advantage in the autocratic Russian Empire. Although these are at liberty to devote their whole time to their own studies, they yet generally choose to contribute several hours daily to the regular work of the observatory, receiving a small compensation therefor." Returning to the United States, he became connected, in 1867, with the National Observatory at Washington; but he had not resided there long before, on the 1st of February, 1867, he accepted the position of director of the Cincinnati Observatory, and he removed there on the 1st of June. This institution, which had been founded through the exertions of Professor O. M. Mitchell, and the corner-stone of which was laid with accompaniment of great public interest by John Quincy Adams, in 1843, had never been adequately supported, and had been virtually suspended for the past half dozen years. Preparatory to taking charge of it, Mr. Abbe visited the other observatories and astronomers of the country, and found everywhere the heartiest pleasure exhibited at the intended resuscitation of the institution. "Each," he says, "seemed to seek to find some way in which to offer assistance and encouragement, while all united in deploring the inaction of the past ten years. There is, in astronomy, a continual endeavor on the part of each one to add something to our knowledge by his own original observations and re-

searches; nor does any one feel that he has attained to any degree of usefulness until this has been accomplished; accordingly, all unite in expressing the hope that we shall now push on in the field of astronomical activity." Encouraged by such expressions, he declared as the sentiment that should actuate the future course of the institution, that "the pursuit of abstruse astronomical investigations, and the utilization of practical astronomy are equally important to the true interests of the observatory, and should be simultaneously cultivated."

In the more detailed plan for the future activity of the observatory which he outlined in his inaugural report, Professor Abbe gave a prominent place to the particular subjects, in connection with which he has won fame. It was his desire, primarily, to extend the field of activity so as to embrace, on the one hand, scientific astronomy, meteorology, and magnetism, and, on the other, the application of these sciences to geography and geodesy, to storm predictions, and to the wants of the citizen and the land-surveyor. In meteorology, he remarked, the observatory ought to keep record of regular hourly observations of all phenomena depending upon observations of the atmosphere: "The science of meteorology is slowly advancing to that point at which it will begin to yield most valuable results to the general community. Although we can not yet predict the weather for a week in advance, yet we are safe in saying that, with a proper arrangement of outposts, we can generally predict three days in advance any extended storm, and six hours in advance any violent hurricane. This may be effected simply by constituting the observatory a central station, to which telegraphic reports of the weather are regularly daily transmitted. The careful study of these dispatches enables the meteorologist safely to make the predictions mentioned, which can be at once disseminated through the public papers or otherwise. In France, Italy, and England, and on our own eastern coast, such storm-warnings are considered of very great importance." The co-operation of the Smithsonian observers and those of the army had already been promised; and at the end of the year, in consideration of the fact that the most of our storms appear on this side of the Rocky Mountains and move eastward, observers had been secured at Omaha, Cheyenne, Sherman, and Salt Lake City. It would also be one of his objects to secure and supply more accurate determinations of time, and for this purpose the observatory would furnish the hour regularly to all the watchmakers who would apply for it; an offer was also made to the municipal government to furnish it to the city.

The location of the observatory in the smoke-saturated atmosphere of Cincinnati had been for some time recognized as unfavorable, and efforts were making to secure a more suitable position for it. While this was going on there could be but little heart in such measures as might be proposed for permanent improvements in the building or the fixed apparatus. It therefore seemed evident that the remaining time

spent upon Mount Adams could be best improved by paying special attention to meteorology. An hourly record was begun of all important atmospheric phenomena. Monthly reports of meteorological observations were received from observers in other cities. The interest of the Chamber of Commerce was engaged in the organization of a system of daily weather-reports and storm-predictions; the gratuitous co-operation of experienced observers was tendered; and the use of the Western Union telegraph lines was offered at a nominal price. The daily "Weather Bulletin" of the Cincinnati Observatory was issued, first in manuscript form, for the use of the Chamber of Commerce, and a week later in print, as an independent publication. It was supported for three months by the Chamber of Commerce, then passed into the hands of the observatory. Finally, the independent publication was discontinued, and the bulletin only appeared under the same title in the morning papers. Subsequently, the publication, by a manifold process, of a daily weather-chart was undertaken, which, in consequence of the observatory's lack of means, was kept up at the expense of the Cincinnati office of the Western Union Telegraph Company. The National Board of Trade meeting at Richmond, Virginia, united in a memorial to Congress, the fruit of which, with other proceedings of a similar character, among which was Professor Lapham's memorial asking for the institution of signals for Milwaukee and Lake Michigan, was the passage of a joint resolution authorizing the Secretary of War to provide for taking meteorological observations at military posts in the interior of the continent, and on the lakes and sea-coasts, for the purpose of giving warning of the approach and probable force of storms.

The superintendency of these observations, or the "Weather Bureau," was put in the charge of General Albert J. Myer, Chief of the Army Signal Service, who appointed Professor Abbe his assistant, or meteorologist. In this position, Professor Abbe, during 1871, organized the methods and work of the so-called "probability" or study-room, in making weather-maps, drawing isobars, ordering storm-signals, etc., and dictated the published official tri-daily synopses and "probabilities" of the weather. In the same year he began and urged the collection of lines of leveling, and in 1872, by laborious analysis, deduced the altitudes of the Signal-Service barometers above sea-level. He instituted in 1872, and reorganized in 1874, the work of publishing a monthly weather-review, with its maps and studies of storms. He urged the extension of simultaneous observations throughout the world, as the only proper method of studying the weather; and, as General Myer distinctly avowed, the success of the negotiations of the Vienna Congress of 1874 was due to following his advice. And he organized, in 1875, the work of preparing the material and publishing the "Daily Bulletin of Simultaneous International Meteorological Observations." Especially is the organization of the numerous State weather services

of the country due to his advocacy, and to the letters sent by his advice by General Hazen to the Governors of the States.

Professor Abbe's unselfish devotion to the pursuit of science for its advancement and not for his own, has prevented his name from appearing as prominently in connection with the work of the Weather Bureau as it deserved to do; but there is a general concurrence of testimony that he has been its guiding spirit. A gentleman, whose special researches in co-operation with it, have given him a world-wide reputation, characterizes him in a note to us as an enthusiastic meteorologist, whose whole soul and energies "seem to have been given to the furtherance and interests of the service. He kept well read up on all meteorological matters, and had a very high appreciation of much that he read; and, when this was the case, he was always very desirous of bringing the matter and the author into notice by means of translations and republications. In fact, he seemed to me to be more desirous of bringing the works and the claims of others into notice than his own. His notes on meteorological subjects, published in the Smithsonian Reports, sprung from his extensive reading and desire to communicate to the public whatever he found of value in the course of his reading. These notes have been very valuable in keeping before the mind the principal results obtained in various ways in the progress of meteorological discovery. Being virtually the scientific adviser of the Signal Service, and having control mostly of its scientific work, on account of his generous and unselfish nature he was not content to occupy the field of scientific work alone, but when General Hazen was put at the head of the service and a more liberal policy toward civilians and in the encouragement of scientific work was adopted, he seemed to wish that all the leading meteorologists of the country could have a part in what he considered the great work of the country, and he especially interested himself in endeavoring to give a chance to promising young men of the country to have a part in this work."

Another gentleman, of world-wide eminence in physical investigation, writes to us: "I will merely state what will, I think, be generally admitted by all competent to express an opinion, that for the good work done by the United States Weather Service, and for the high estimation in which it has been held by Europeans generally, the country is indebted to Professor Abbe more than to any other one man. He was unquestionably the first to put into actual operation the scheme of telegraphic weather-warnings, and thus to realize the suggestions and hopes of Professor Henry in that direction. This he did at Cincinnati, Ohio, before the organization of the United States Weather Service. . . . It was his success in this preliminary work at Cincinnati which led to his being called into the service almost immediately after the organization of the Weather Bureau as a branch of the Signal Service of the United States Army. His relations to this service have always been in some degree anomalous and yet of the very highest importance. . . .

In the beginning he was the one man in the service who knew much of meteorology, and from that time to the present he has been conspicuously the representative of that science in Government employ. The constant change in the *personnel* of a bureau of the army, the continued coming in of this officer and the going out of that, is one of the serious obstacles in the way of the successful cultivation of a science, either pure or applied, under a military *régime*. The weather service has been preserved from stagnation and decay by the continued presence of such an ardent student as Professor Abbe. On all important questions touching the scientific work of the service, his advice has been sought by the Chief Signal Officer; most plans for its improvement and extension have originated with him, and he has done much to stimulate the study of meteorology outside of the service as well as within it."

We are informed by Mrs. Hazen, widow of the late Chief of the Signal Office, that Professor Abbe was always held in high esteem by her husband, "and relied on not only as a very scientific man, but as a loyal friend." This sentence brings out another salient trait in his character—his loyalty to his chief. Readers of the "Monthly" will recollect the tribute which he improved the first opportunity after General Hazen's death to pay to his character and the worth of his work for science; but they do not know, for that is matter of personal confidence, that he was extremely anxious that General Hazen should receive full credit for all that he did, all that he helped to do, and all that he was in any way the means of having done for science; and particularly that he should be vindicated from the unfriendly criticisms which the newspapers had cast against him—all of which Professor Abbe believed to be unjust and unfounded.

Professor Abbe's efforts, while engaged at the Cincinnati Observatory, to furnish accurate time to the watchmakers and the public clocks of the city have already been mentioned. This service he regarded as always a daily duty in a well-organized observatory. Similar work was already performed by a number of observatories in America and Europe, one of the earliest instances of it being the giving of the time to the city and province of the Magnetic Observatory at Toronto in 1842. The British Astronomer Royal began the dropping of the noon time-ball at Deal in 1852, and was followed by the United States Naval Observatory at Washington in 1855. An automatic apparatus for controlling the public clock from the observatory was ordered in Cincinnati in 1870. Afterward the Pennsylvania Railroad Company intrusted its time-signals to the Allegheny Observatory, under Langley. In 1877 an arrangement was made between the Naval Observatory and the Western Union Telegraph Company for delivering time-signals at important places in the United States.

The inconveniences arising from the ever-varying standards of local time, which required a change of the watch for every few miles of traveling east or west, had attracted an increasing attention for many

years, and had been the subject of earnest discussion by the general time conventions of the railroad officials. The matter was also taken up by Professor Dowd in 1870, and was agitated by the American Metrological Society, which at Abbe's suggestion appointed a special committee on the subject, the American Society of Civil Engineers, and the American Association for the Advancement of Science. Professor Abbe, Dr. F. A. P. Barnard, Mr. E. B. Elliott, and Mr. W. F. Allen were among the earliest, and were at all times the most active and efficient, advocates of a reform in this matter in the United States. The most practicable way to secure a reform seemed to be to induce the railroads of the country, which were shown to be using no less than seventy-five different standards in regulating the movements of their trains, to accept some uniform system. Hitherto it had appeared impossible to agree upon any plan which they would recognize as practicable. Some persons advised a uniform standard for the whole country, such as the time of the seventy-fifth meridan (nearly Washington time) or of the ninetieth meridian, while others proposed the "hour difference" plan. Professor Abbe was the chairman of the committee on the subject of the American Metrological Society, and in 1879 presented a report in which the whole question was carefully reviewed. This report embodied a number of resolutions, advising the discontinuance of the use of local times and the adoption instead of the standards of the principal railroads in their respective localities; and suggesting to railroad officers a reduction of their time-standards to one for every hour of longitude. But while the adoption of a few standard meridians was regarded as an improvement, which could be no inconvenience, but would tend to diminish inconveniences already almost intolerable, the committee could "but look upon it as only a step forward by the community at large toward that absolute uniformity of all time-pieces, that is, we think, already practicable on the part of railroad and telegraph companies." The adoption of an absolute uniformity of time throughout the whole country was therefore urged upon those companies and all kindred associations, and the time of a meridian six hours west of Greenwich, or the ninetieth meridian, was recommended as such ultimate common standard. The adoption of the reform thus indicated would, the committee believed, materially help toward the adoption of a uniform standard throughout the world. This standard, it was suggested, could most conveniently conform to the meridian one hundred and eighty degrees from Greenwich. Nevertheless, this question was regarded as one for the distant future, to be considered in some international convention. "This report," says Professor Dowd, in relating the part which he had taken in the movement, "is specially worthy of mention, as it seemed to present the first plan, other than the one forming the subject of this paper, for systematizing the time-standards of the country. Although the report centered upon one time-standard for the country—the plan upon which I started and

which I had felt obliged to abandon—yet it grouped together so much practical information, and was so suggestive of new lines of thinking, that it really marked a new era in the history." Professor Abbe presented another very important report to the Metrological Society at the December meeting of 1880. President Barnard was appointed to draw up a circular upon the subject, and send it out to all who might have an interest in the matter; and with the help of Mr. Allen, of the Railway Time Convention, the plan of hourly-standards, which is now in use, was prepared, and the co-operation of nearly all the important railroads secured for its successful introduction.

As the delegate of the United States to the International Meridian and Time Conference, which met at Washington in October, 1884, Professor Abbe presented an argument which had considerable weight in deciding the questions at issue, although it was only circulated in proof-sheets among the members, and was withheld from publication because if it became official it would necessitate a long reply from the French delegates, and prolong a discussion that was likely to be unnecessarily tedious. In this paper he offered as a solution of the question of the real neutrality of the prime meridian, which the French delegates insisted upon, the proposition that "the prime meridian shall be defined by references as exact as may be practicable to all the national astronomical observatories of the twenty-five nations represented in this conference; the grounds belonging to these observatories shall be declared neutral territory, and the astronomers in charge shall be respected in all international matters; the precise choice of the prime meridian shall be based on the principle of doing the least possible violence to the existing customs of the world consistent with the attainment of the greatest possible good; that when adopted this meridian shall receive no national designation obnoxious to any people, but the whole system shall be known as the International Prime Meridian, International Longitude, International Time."

Professor Abbe led the party which went out from the Cincinnati Observatory to observe the total eclipse of August 7, 1869. The company traveled in wagons from Sioux City to the line of totality near Sioux Falls. His own attention was devoted to the observation, under high power and in a small field of view, of three conical protuberances of peculiar character, and he missed the coronal streamers which were observed by the others with the naked eye and with opera-glasses; and he doubted whether the latter were not individual and subjective phenomena, or originating in the earth's atmosphere.

At the eclipse of August, 1878, he selected a station on the summit of Pike's Peak, but was taken ill there, and had to be removed to the Lake House (elevation ten thousand feet). Having recovered to a sufficient extent, he was laid upon the ground during the eclipse and devoted himself wholly to the study of the rays that extended above the brilliant ring which was presumed to represent the true solar at-

mosphere. On this occasion, these rays revealed themselves so distinctly and brightly, and shone with such steady light, that he could no longer doubt the accuracy of the accounts of his fellow-observers of the eclipse of 1869, nor that the phenomena were independent of personal equations and atmospheric effects. He explained them as being due to reflection from the streams of meteor-dust which are supposed to be constantly flowing toward and around the sun.

The list of Professor Abbe's published papers down to 1880 includes eighty-four titles, several of which cover more than one article. The papers relate chiefly to subjects in astronomy and meteorology, and to matters connected with the author's particular work. They include reports and other articles of a documentary character, seventeen articles in "Appletons' Cyclopædia," nine in Johnson's, contributions to Baird's "Annual Record of Science and Industry," articles in scientific periodicals, and articles in newspapers—all tending directly to the increase or diffusion of knowledge. Professor Abbe has been engaged for many years in the supervision of a bibliography, which is now near completion; and has completed a treatise on meteorological instruments that will soon be published by the Signal Office.

Some of Professor Abbe's personal qualities have already appeared incidentally in the regular course of this sketch. The key to them appears to be unselfishness—a virtue which has been prominently manifested through the whole of his life. His classmate, already quoted from, writes: "Everybody liked Cleveland Abbe thirty years ago, as I suppose everybody likes him now. He was unselfish, modest, kindly then, and, in disposition, though only twenty years old, a scientific man, a lover of scientific truth." A scientific friend, whom also we quoted before, corroborates this, saying: "In disposition, he is unselfish to a rare degree, generally managing that others shall get the credit for work in which he has had a large share. To this characteristic, together with the somewhat peculiar code of ethics which prevails in the Government service, must be attributed the fact that his contributions to the science of meteorology have appeared less frequently than was hoped for by some of his friends."

His policy in connection with the Signal Service is eloquently described in a letter of January 28, 1886, presented by General W. B. Hazen to the Joint Committee of Congress on the Signal Service, and printed in the bulky volume of testimony, where he says, page 1057, "Until finally accepting the inevitable, he announced it as his own established policy, on the one hand, to himself prepare little or nothing for publication of an original nature; and, on the other hand, to advise, assist, and stimulate the work of every member of the service to the very best of his ability." This policy is now ended by the special orders of Generals Hazen and Greely, who have directed that his time shall be mainly given to those greater works that the world has a right to expect from his knowledge and experience.

EDITOR'S TABLE.

INTERNATIONAL COPYRIGHT.

THE latest scheme for an international copyright combining some of the more prominent provisions of earlier plans with a new feature of his own, is offered by Mr. R. Pearsall Smith of Philadelphia, and printed in a recent number of the "Nineteenth Century." The comments on the plan of a dozen distinguished Englishmen accompany the article, the publication of which, whatever the fate of the proposal, has served at least one good purpose. By renewing attention to the subject it has set people thinking and provoked discussion, and in a case fraught with such rank injustice to our home as well as to foreign authors, every general stirring up of the question must do good. It will help to quicken the moral sense of the community, and perhaps in time will make it lively enough to force Congress into the performance of what all right-thinking persons are agreed is a clear national duty.

Of the plan itself, however, as a practical working solution of the difficulty, little that is favorable can be said or expected. Accustomed, through the piratical practices of former years, to an abundant supply of low-priced literature, American readers will not, it is claimed, consent to a monopoly copyright on foreign books, or, put in another form, they will continue to deny to the property rights of the foreign author that reasonable measure of protection which is now freely accorded to the rights of our authors at home.

The reasons assigned for their persistence in this palpably unfair discrimination are, in substance, that such a law would mean English prices for foreign books in this country; it would cause a great diminution in the volume of our literature; cheap editions would disappear from the market, and the publisher would be enriched at the expense of the reader, without any corresponding benefit to the author.

To avoid this imaginary revolution in the literary affairs of the United States, and at the same time secure to the foreign author his dues, the scheme in question proposes to give to any one in this country the privilege of publishing in any style and at any price he sees fit, any foreign book he may select, on condition that he *first* pay to the author a royalty of ten per cent on the retail price of each copy of the work he *expects* to sell. The evidence of his compliance with this requirement is obtained in the form of stamps, which the author is obliged to furnish to every applicant, or as a penalty for refusal suffer the loss of all his American rights. A single stamp is to be affixed to each copy of the book before it leaves the publisher's hands; and is thus expected to serve as a check on possible attempts to dispose of unauthorized editions.

To illustrate the way in which an arrangement of this kind would be likely to work in practice, we will suppose that some spirited author ventures upon a choice of publishers, and finding one who is bold enough to negotiate, he bargains to have his book brought out in a style suited to the subject, to his own reputation, and to the class of readers he is expecting to reach, trusting the result to the joint interest of his publisher in the enterprise. The next week, six months, or perhaps a year later, as the case may be, he is compelled under the new law to mercilessly cut the throat of his business associate, wiping out his property, and destroying his market, in the interest of another publisher, who, shrewd enough to see his opportunity and having the game in his

own hands, demands the stamps for an inferior and low-priced edition. Under such a condition of things, publishers of ordinary business sagacity would be slow to assume even the smallest risk, the utter insecurity of the property making all business enterprise in that direction precarious. In this connection, we can not do better than to give the views of Mr. W. H. Appleton, whose long experience as a publisher enables him to speak with an authority which greatly outweighs the untried speculations of one who, like the writer in the "Nineteenth Century," has no practical knowledge of the business. Referring, in 1872, to a proposed international copyright law that was then under discussion, and which, like the present plan, provided for open competition in the reprinting of foreign books, Mr. Appleton said:

> The first demand of property is for security, . . . and to publish a book in any real sense—that is, not merely to print it, but to make it well and widely known, requires much effort and larger expenditure, and these will not be invested in a property which is liable to be destroyed at any moment. . . . The publisher can neither afford to make the book so thoroughly known, nor can he put it at so low a price as if he could count upon a permanent and undisturbed control of its sales. Many valuable books are not reprinted at all, and therefore are to be had only at English prices, for the same reason that publishers are cautious about risking their capital in unprotected property.

In its other business aspects, such as the opportunities it affords for fraud, the possible difficulties in recovering the value of unused stamps, and the general influence on the trade of the uncertainties of open competition, the plan is equally objectionable. Indeed, taken as a whole, it seems much better adapted to the purpose of quieting our consciences while we hang on to the plunder, than to the furtherance of its ostensible object—the benefit of the British author.

The fact is that the assumption on which the whole scheme is based, viz., that American readers will not accept a monopoly copyright on foreign books, is untenable, and is, in the opinion of many, squarely contradicted by the facts. For three quarters of a century Americans have bought books at fair prices under monopoly copyright without finding fault, and, moreover, when the demand arose, have enjoyed the advantage of lower-priced editions However it may be slurred or ignored, the truth is that the American people have had a great deal less to do with this denial of justice to English authors than the publishers and the politicians; and when some member of Congress, in pursuit of a little cheap political capital, sets up the plea that his constituents are not willing to pay fair prices for the foreign author's property in this country, he may very reasonably be asked to back up his statements with some unmistakable expressions of feeling from the people themselves. That American readers have accepted and upheld a monopoly copyright at home may, until we have something definite to the contrary, fairly be taken as an indication that, when made acquainted with the true bearings of the case, they will be equally fair toward the interests of the foreign author. As a matter of fact they have already given abundant evidence of this kindly feeling in the purchase of substantial editions of English and other foreign reprinted books of a solid character, amounting in the aggregate to hundreds of thousands of volumes, paying prices therefor which have enabled the few high-minded publishers who voluntarily entered into the arrangement to hand to the foreign author exactly the same return that he would have received if a citizen of this country. The publishers following this practice have been able to make and sell these books at American prices, and have also found their profit, when the demand would justify the venture, in the sale of cheap editions. Of course, in doing this they exposed themselves to serious risks, and but for the old-time courtesy of the trade, by which they were to a considerable extent pro-

tected, it would have been impossible; and the fact that with the recent enormous development of piracy, which respects nobody's rights of property, they have suffered material losses, is but a confirmation of the point that the open competition proposed in the present plan would have exactly the same effect that piracy is having now.

In fact, then, we have a practice which has grown up under existing conditions that makes no distinction between our authors and those of other countries, which is supported by a large class of readers, and which only needs the simplest legal sanction to completely solve the question of international copyright without resort to untried, complicated, and otherwise doubtful business methods.

Looked at from the moral side, which really is the only proper stand-point, Mr. Smith's plan is, if possible, open to still stronger objection, and its defects in this respect are so cleverly and forcibly pointed out by Professor Huxley in the "Nineteenth Century" that we make no apology for quoting his remarks in full. He says:

I find in Mr. Pearsall Smith's interesting paper two chief matters for consideration: the one is a statement of the moral principles by which the transatlantic English-speaking people propose to govern themselves in dealing with the property of British authors; and the other is a plan for securing to the said British authors such a price for the use of their property as is compatible with the moral principles in question. The principles are very easily gathered from Mr. Pearsall Smith's candid exposition of them. Transatlantic readers, it appears, by no means go so far as to deny that a book is the property of its author; and they are evidently quite shocked at the notion that, when they possess themselves of a pirated edition, they may be placing themselves in the position of receivers of stolen goods. Their conscience has been stirred to its depths by the suspicion that such may be the case, and will give them no peace until they are satisfied that the man whose genius has charmed away their sorrows or opened up new vistas for their intellect has not been left to starve on mere praise. All they ask (and they seem to think the request a grace) is that they themselves shall be the assessors of the pecuniary value of their obligations. "Our souls require moral and intellectual elevation; we are accustomed to get these elevators cheaply, and we mean to go on getting them cheaply. We shall be happy to consider any arrangement for rewarding the makers of the elevators consistently with that declaration; but they had better recollect that we are masters of the situation, and that we shall appropriate our spiritual nourishment without payment, if we can not get it at our own price."

In England we still retain so much of the ingrained conservatism of the decaying civilizations of Europe, that, if a starving man goes into a baker's shop, and carries off a sixpenny loaf, leaving only twopence in its place, the poor wretch is haled before the nearest magistrate and sent to prison for a thief. It would be no good whatever for him to plead that his bodily frame absolutely required to be elevated and kept erect by regular installments of bread; that he had been accustomed all his life to get a big loaf for twopence; and that, in his judgment, the baker got quite enough profit out of the twopence—to prison he would go. But see the difference. The starveling is not (at any rate yet) master of the situation, and the baker (*plus* the magistrate) is. However, we are altering all these things rapidly. It has become an axiom among a large and influential class of our politicians, that a want constitutes a good claim for that which you want, but which other people happen to possess. The "earth hunger" of the many has established itself as an excellent plea for the spoliation of the land-owning few; lease-holders are already trying the effect of "house-hunger" on house-owners; and the happy time seems approaching when the consumer, and not the producer, will fix the price of all things desirable. The course of action by which, according to Mr. Pearsall Smith, transatlantic readers propose to deal with British authors, is but another anticipation of that social millennium when the "have-nots," whether they lack land or house or money or capacity or morals, will have parted among themselves all the belongings of the "haves"—save the two last mentioned.

The proposed plan for "protected copyright with free-trade competition" has one merit. It recognizes the right of property of an author in his work. It is a frank confession that piracy is theft. But, as a practical measure, I can not say I feel any confidence in its working. The author is to provide

stamps for each copy of his work, and anybody who chooses to publish it is to obtain the number of stamps required for his edition, on paying ten per cent of the publishing price to the author or his representatives. It appears to me that there are serious—not to say fatal—objections to this project from the point of view both of the author and of the publisher.

From that of the author, because unless the stamps are executed with the care and cost of a bank-note, they may be counterfeited with the most tempting eagerness. Suppose that I had the good fortune to be the author of a popular novel, and that I found that some scamp of a bookseller was issuing an edition with forged stamps at Chicago, and another playing the same game at Toronto. Unless I happened to have a few thousands of which I desired to make ducks and drakes, is it conceivable that I should be so foolish as to take action against my defrauders in the civil courts of these two cities, when, in all probability, the judge would have a copy of the pirated edition in his pocket, while bar and jury were equally well provided? How shall Angelo condemn Claudio without many qualms? Suppose I succeeded and obtained the award of five times the retail price of the cheap edition—which is the maximum fine proposed—to what extent would that recoup me for law expenses, worry, and loss of time? Legal administration is comparatively cheap and swift in Scotland; but an eminent Scotch judge once told me that if he were riding along Leith Walk, and somebody preferred a claim to his horse and took it away, he should think it, on the whole, better to put up with the loss of the horse, than to go to law with the spoliator. Certainly it would be better for the English author to sell all he had and give it to the poor, than to undertake a copyright process in the United States or Canada in the face of the existing feeling that "our people" have a right to "nourish themselves and their children," as Sir C. Trevelyan put it, on cheap books. The former process, at any rate, would not leave him in debt.

And now as to the position of the publisher under the proposed arrangement. My experience of publishers, both in England and America, has been such as to lead me to differ somewhat from the estimate which many of my brethren seem to form of them. So far as my observation has gone, they have as much claim to the possession of souls as other people; and I have not been able to convince myself that the portion of inherited depravity in the average publisher is greater than that implanted in the average author. I have frequently asked myself whether, for any possible benefit which my publishers get out of my books, I would or could submit to the worry, loss of time, and pecuniary risk of bringing them out on my own account; and I have had no difficulty in answering this question in the negative. But there are publishers and publishers, and there are various fashions of bringing out books.

As our transatlantic readers admit that an author has some right of property in his work, I am a little perplexed to understand why they deny his right to appoint the agent * on to whose shoulders he desires to throw all the burden and risk of giving that work a practical existence, and to decide in accordance with him the form of their joint produce and the remuneration they may ask for it. The farmer, the miller, and the baker decide the price at which they can afford that the loaf which they have jointly produced shall be sold. In revolutionary times, starving mobs, desiring to have the sixpenny loaf for twopence, call the baker a monopolist, and proceed to hang him *à la lanterne*. The transatlantic people, impelled, as it appears, by their spiritual cravings after the intellectual and moral elevation imparted by the works of English authors, call the publisher, who stands in the same relation to the author as the baker to the farmer, a "monopolist." Heaven forbid that I should suggest that my excellent friends, the Messrs. Appleton, may stand in danger now or hereafter of the *lanterne*. Not at all! The sixpenny loaf can be got not merely for twopence, but for nothing, without any such violence, by simply continuing the present practice of piracy, checked only by the underselling power of the strong houses.

Grant, however, that the appointment by the man who possesses a property of an agent to administer that property, according to such terms as they may mutually agree to, is an offensive act of monoply on the part of the owner—what will be the practical working of the scheme which it is proposed to substitute for this old-world expression of rights of ownership?

I suppose myself an American or Canadian publisher. I hear that the celebrated English author A. B. is about to produce a work which is certain to be greatly in demand on my side of the Atlantic. As things are,

* I see no reason for demurring to the requirement that the agent should be a native of the country in which the sale is to take place, if, as is asserted, there are strong practical grounds of objection to any other arrangement.

if I bring out an edition of ten thousand, I, in the first place, risk the whole prime cost of that edition on the accuracy of my judgment of the public taste. To those who have had experience of the uncertainty of such judgments this will probably seem enough. But the new scheme proposes that I shall add to this risk the deposit, with the author or his representatives, of a sum equal to a thousand times the selling price of a single copy, with the prospect of a possible lawsuit against a man who is usually not rich, an indefinite time afterward, to get back the value of stamps for unsold copies in case I have made a mistake. And, for all this additional trouble, risk, and tying up of capital, I get absolutely nothing. It is open to my rival in the next street to write for the necessary stamps and undersell me whenever he pleases. For the publisher, therefore, the state of things would remain exactly as it is now—a condition of internecine warfare, in which only those houses can afford to pay copyright who are wealthy enough to break down any one who trenches on their ground. The relation of authors to publishers in America at present is exactly that of the traveling merchants to the barons of the middle ages. Put yourself in the hands of any one of them who was strong enough, and he protected you against all the rest; otherwise, you were every man's prey. I do not see how the projected scheme will alter this state of things. It is further to be considered that the new proposal leaves the author absolutely at the mercy of anybody who applies for stamps. The publisher may turn out an ill-printed, ill-corrected version (perhaps improved and amended to suit the taste of the transatlantic people), and the author has no remedy.

In the case of illustrated works the wrong may be still more gross. I speak with some knowledge of the cost and trouble of preparing illustrated scientific books. The author may spend months or years in dissecting and preparing the requisite objects and in making or superintending the execution, in the first place, of drawings from them, and, in the second place, of the engravings made from these drawings. It rarely happens that he obtains more than the most bare and scanty remuneration for the labor thus spent, which often is as great as that of writing his book. The work being published in England, an American publisher writes for stamps for an edition, say a third or a fourth of the price per copy of the English one. It is perfectly easy for him to do so; the paper and the mere type-setting after a printed book do not come to much, and the illustrations, which have cost the producer so much trouble, can be reproduced at a fraction of the cost of the originals. If they are course and clumsy, with references half wrong, what matter? The discredit is put down to the author's account.

In conclusion, I am of opinion that this proposal for "protected copyright with free-trade competition" is false in principle, and, so far as English authors and transatlantic publishers are concerned, would be futile in practice. If adopted, it will merely come to the issue of letters of marque to people who are now frankly pirates. The French valet said to the master who offered him so much a year if he would leave off the pickings and stealings, "Monsieur, je préfère de vous voler." I may paraphrase the candid valet's confession, and declare that if I am to be robbed I prefer to be robbed openly.

If the transatlantic reader admits, as he professes to do, that an English author has rights of property in the book which he has written, he seems to me bound further to admit that the author may at least appoint an agent in the reader's own country with the exclusive right to make and sell the book under such conditions as that agent, knowing the wants and condition of the community, may think prudent and reasonable. If my transatlantic friend calls that proposal "undisguised monopoly," I call any which offers less to the author more or less disguised piracy.

LITERARY NOTICES.

Our Heredity from God: Consisting of Lectures on Evolution. By E. P. Powell. New York: D. Appleton & Co. Pp. 416. Price, $1.75.

The author of this book is pastor, we presume, of a society in Utica, who, having been born and bred in Calvinism, experienced a shock, as he phrases it, "in the face of its dire failure to explain the universe, to apologize for God, or to save mankind." Having lost faith in authoritative revelation, he sought in the study of evolution deliverance from the chaotic condition in which his mind was left. The outcome of his struggles and the purpose of his book are expressed in his declarations that "earnest and honest men can not too soon comprehend that our only salvation is in that evolution which has led from the primordial cell to Jesus and Plato, and has lifted life from the hunger for protoplasm to the hunger for righteousness. No religion but that

of evolution can end anywhere but where it begins, in a chaos of creative purposes thwarted and disrupted, and in an eternal struggle to amend a shattered divine plan"; and "there is one—and that the simplest—explanation of the universe, which, while showing sustained progress in the past, pledges eternal betterment in the future. This is the gospel of hope for all those who choose to go forward with the supreme moral purpose; it is the gospel of degeneration to every one who, declining obedience to the laws of ethical living, contents himself with animal functioning." The charms of the author's poetic mode of thought and warm style are indisputable. The treatise is divided into three parts, the first two of which are introductory to the main argument, which is developed in the third. In the first part are summed up the leading arguments in favor of evolution, as accounting for structural variety, and as able to explain the actual condition of living creatures. These arguments are given in harmony with the expositions of Spencer, Darwin, and Wallace, as the arguments from the Unity of Nature, from Geography, Geology and Anatomy, Development and Reversion, the Power of Mimicry, and Degeneration. In the second part are shown the commonalty of life between all creatures, and how definitely the links in a consecutive development of life have been established, from the jelly-fishes of the primeval seas to man. In the chapter, "Animals on the Road," in this part, numerous incidents are related showing how nearly many animals have approached to human reason, and how closely they have come to sympathy with man and understanding of him. In the third part, evolution is followed after man is reached, to show that there is not only one evolution of all life, including man and animals, interlinked in origin and in their progressive changes, but that human history, its religions, morals, arts, culminating in universal ethical laws, is also a subject of evolution. The chapter, "Co-operation in Evolution," showing how the vegetable and animal world, from the remote past as now, and man co-operate for development, points out, "that from the very outset, evolution has implied something besides a mere brute struggle for existence; that it involved a mutual helpfulness and co-operation for a common good, and that Nature stood pledged in the cell to create a moral intelligence, and in every cataclysm to establish as the ultimate law, 'On earth peace, good-will to men.'" The first men are believed to have appeared while gigantic saurians still prevailed on the earth, and had to contend with them; hence the serpents as powers of evil in the mythologies. The succession in development was kept up with the drift men, cave men, Iberians, Turanians, and Aryans, each race having advantages over the race that preceded it, and marking a step or steps in civilization. Human life, the family, the state, and the Church, underwent a continuous progress under the combined influence of the laws of heredity; of the spontaneity of evolution or the begetting of ideas one from another; of periodicity, or the running of the courses of ideas and lines of thought in given periods; of irritability, of which the stimulus, antagonism, has been the lever of advance; and of slow achievement. The general course of progressive thought began with the knowledge of natural phenomena and attempts to refer them to adequate causes; whence have sprung, in succession, an agglomeration of myth and science, as theology; a code of arbitrary morals, based on existing knowledge and mythology; attacks on established ritualism and belief, ending after bitter strife in a Reformation; and the establishment of the new heresy as orthodoxy, to be in its turn attacked and superseded. Successive steps in the evolution of mankind were marked by the growth of commerce; tribal life; writing; Greek philosophy; philosophy and oratory; Buddha and Confucius; and, finally, Jesus, who from the stand-point of evolution "does not appear as the incarnation of God, but far more than that, as the incarnation of one hundred thousand years of man. Yes, more, as the incarnation of all life, from its dawn on the earth." "No man," the author declares, "can live in the light and the life of the nobler era of brain, of science, of philosophy, of moral truth, and not behold the face of Jesus of Nazareth as the prophet, the foreseer of the later evolution"; and, "it is impossible that those who are not students of evolution, those who suppose

men are failures and not a success, and that they were created but a few years ago, should comprehend the character and place of Jesus in history." In the next chapter the workability of the golden rule is inquired into, with the conclusion that it is sure to be approximated, but never absolutely attained; in the next, is considered the future of evolution, which "has to do with a fact larger than man, even with life itself"; in the next, ethics is presented as the aim of evolution. The author next looks for "the self that is higher than ourselves," and finds, not a final cause or God outside of and apart from Nature, but that "the magnificent reign of life and law that is unfolding year by year and age by age is but the pulsating presence of Him who is over all, through all, interpenetrating all." The final chapter relates to "that last enemy, death," and the question of immortality.

THREE GOOD GIANTS, WHOSE FAMOUS DEEDS ARE RECORDED IN THE ANCIENT CHRONICLES OF FRANÇOIS RABELAIS. By JOHN DIMITRY. Boston: Ticknor & Co. Pp. 246. Price, $1.50.

UNCLEAN as Rabelais is, and wandering seemingly without method around the sphere of thought and coarse wit, the world has agreed that there abound in him gems of thought worth the having—if some one else will dig them out. Mr. Dimitry finds in his great work, too, three admirable characters, whose lives and adventures constitute a wondrous story; and this he has dug out, and presents to young readers free from all that is gross, and untrammeled by philosophical and other disquisitions that do not help it along; or, as he himself expresses it, has placed the famous trio, Grandgousier, Gargantua, and Pantagruel, "high and dry above the scum which had so long clogged their rare good-fellowship, and which had made men of judgment blind to the genuine worth that was in them." He finds a kind of evolutionary development going on in his heroes as the generation proceeds from grandfather to grandson. To these colossal creatures, he says, "fashioned in ridicule of the old fantastico-chivalric deeds of their age, as they come down more and more from the clouds, are more and more given the feelings common to this earth's creatures. All three bear, from their birth, a sturdy human sympathy not natural to their kind, as mediæval superstition classed it. Two of them, in being brought to the level of humanity, join with this a simple Christian manliness and a childlike faith under all emergencies, not set on their own massive strength, but fixed on God. . . . From Grandgousier, the good-hearted guzzler, through Gargantua, through his heady youth and wise old age, to 'the noble Pantagruel,' the gain in purity and Christian manhood is steady." The justification of this conclusion may be sought in the story as the author has picked it out and arranged it. The presentation is most attractive, in bright pages and clear type, with illustrations by Gustave Doré and A. Robida.

THE RELATIVE PROPORTIONS OF THE STEAM-ENGINE. By WILLIAM DENNIS MARKS, C. E. Third edition, revised and enlarged. Philadelphia: J. B. Lippincott Company. Pp. 295. Price, $3.

IN the first edition of this book the author expressed regret at the failure of all writers upon mechanics or the steam-engine to give, in a simple and practical form, rules and formulas for the determination of the relative proportions of the component parts of the engine. In this was the reason for his own effort, the lectures which comprise it having been written with the feeling that a rational and practical method of determination was yet a desideratum in the English literature of the subject. In preparing the lectures, he omitted the consideration of such topics as had already been overwritten, and considered only those which seemed not to have received the attention which their importance demanded. The additions made in the third edition are principally concerning the limitations of the expansion of steam. The importance of taking into account the condensation of steam by the walls of the cylinder is insisted upon. Keeping this point in view, the author has endeavored to formulate the hitherto unknown law of condensation inside of the cylinder. He claims to have shown that the wide differences in experimental results of tests of different types and sizes of engines are not irreconcilable; and it has been sought by quantitative weighing of results to define the limitations of the various expedients which engineers have made in the effort to

realize the most from their steam, and to enable others to see where and how they should be used. The whole book is interpaged with blank leaves, on which students can record their notes as they go along.

JOHNS HOPKINS UNIVERSITY STUDIES IN HISTORICAL AND POLITICAL SCIENCE. Fifth Series. No. VII. THE EFFECT OF THE WAR OF 1812 UPON THE CONSOLIDATION OF THE UNION. By N. M. BUTLER. 25 cents. No. VIII. NOTES ON THE LITERATURE OF CHARITIES. By H. B. ADAMS. 25 cents. No. IX. THE PREDICTIONS OF HAMILTON AND DE TOCQUEVILLE. By JAMES BRYCE. 25 cents. Baltimore: The University. 1887.

THESE latest issues of this interesting series treat a variety of topics. Professor Butler's work is designed to show how the War of 1812, by uniting the people for the purpose of the common defense, and by stimulating the sentiment of national pride, contributed to produce a more truly national spirit than had prevailed in the country before. He shows how strong the sectional spirit had been before that time, and even during the war itself; and makes it clear that the war was one of the most potent agencies in creating a better public opinion.

The pamphlet by Mr. Bryce is on a more difficult theme, being a review of the opinions expressed by Hamilton and De Tocqueville, respectively, in regard to our national Government and the perils attending its future. The chief dangers, in the view of both writers, were the tendency to sectionalism and disunion, and the apprehended tyranny of the majority. That there was ground for fearing the disruption of the Union, we now know; yet neither the American nor the Frenchman saw that slavery was the prime source of danger. Some of their predictions have proved very far from true; but Mr. Bryce shows that they were much wiser than the opponents of the Constitution in 1788, whose objections have all turned out to be groundless. On the other hand, some of the evils that have actually developed in our politics, and are most observable to-day, such as the abuse of party machinery, the spoils doctrine, and the corrupting influence of wealth, were not foreseen by any one. Mr. Bryce himself carefully abstains from prophesying, believing that predictions in morals and politics are of little value.

The little work by Professor Adams, on the literature relating to charity will doubtless be useful to special students of that subject. It describes the publications of a large number of charitable organizations, together with many works in general literature bearing upon benevolence.

ON THE WARRIOR COAL-FIELD. By HENRY MCCALLEY. Montgomery, Ala.: Barrett & Co., State Printers. Pp. 571.

THIS volume is one of the reports of the Geological Survey of Alabama, which is conducted under the superintendency of Mr. Eugene Allen Smith, State Geologist. It contains descriptions, by counties, of all that has yet been made visible to the surveyor and miner of one of the thickest and fullest coal-fields in the world, the quality of the product of which is, moreover, not excelled by that of any other. The coal lands of Alabama, which belong to the great Appalachian coal-field, comprise, altogether, an area of 8,660 square miles, but are divided up by anticlinal ridges into three parts—the Warrior, the Cahaba, and the Coosa coal-fields. Of these, the Warrier field is very much the largest, for it embraces an area of 7,810 square miles. It is a broad, shallow, tray-shaped depression, sloping toward the southwest, with its southwest end covered by a newer formation, and its southeast side complicated by folds and fractures. It has been conveniently divided into a plateau and basin area, which gradually merge without any distinct line of demarcation. The coal-seams range in thickness from a few inches to about fourteen feet, the thicker seams always containing more or less slate or clay as partings. There appear to be about thirty-five of these seams eighteen inches and more in thickness, of which fifteen are of two feet six inches and over, and six are four feet and over; but they thin out toward the northeast. The quantity of coal is estimated at 113,119,000,000 tons, of which 108,394,000,000 tons would be available coal or contained in the seams of eighteen inches or more in thickness—or about three times as much as the estimated available bituminous and semi-bituminous

coals of Pennsylvania. The coals, though all bituminous, are of many kinds and qualities. The amount mined during the past fifteen years had increased in a very rapid ratio from 11,000 tons in 1870 to 2,225,000 tons in 1885; and the amount of coke manufactured from 60,781 tons in 1880 to 304,509 tons in 1885. The Warrior coal-field has besides its coal three or four seams of blackband iron-ore, considerable clay ironstone, great quarries of the best of building and paving stones, and forests of most excellent timber.

A DICTIONARY OF MUSIC AND MUSICIANS. Edited by Sir GEORGE GROVE. London and New York, Part XXII: Macmillan & Co. Pp. 134. Price, $1.

THE present part completes the text of this important and comprehensive work, although an appendix and a full index are announced as in preparation. The "Dictionary" as a whole bears ample evidence of the scholarship and careful research of its editor and contributors. It is worthy of a place among the best cyclopædias, while it is also of great account as a literary work and has a very high value as a book of reference. A course of musical instruction might be gathered from the articles in it. It gives accounts of all the different kinds and styles of music; those of the different nations, of different epochs, of the different schools, those which mark the individual traits of composers, those which respond to peculiarities of the people, and those which illustrate or are illustrated by passing events. The several kinds of compositions are described, defined, and distinguished. The various instruments have places among the articles. Biographies are given of all musicians, including composers and performers, who have made their names known, which are full according to the importance of the subject. In short, whatever pertains to the history, character, and accessories of music, is treated, or intended to be treated, in its alphabetical order, in the four volumes. The literary merits of the longer articles make the book desirable from that point of view. The present part contains the articles from "Waltz" to "Zwischenspiel," or the end of the list. The fullest and most interesting among them is Dr. Philipp Spitta's account of Carl Maria von Weber and his works, which occupies more than forty pages, and is bright with the warmth of the writer's appreciation of the brilliant composer and his inspiring music.

REPORT OF SPENCER F. BAIRD, SECRETARY OF THE SMITHSONIAN INSTITUTION, FOR THE YEAR 1885–'86. Washington: Government Printing-Office. Pp. 83.

AMONG the interesting features of this report is the account of the growth of the National Museum, which included, at the time of reporting, 2,420,934 "lots" of specimens. Among the special collections are to be noted that of scientific instruments, to many of which rare historical associations are attached; the baskets, throw-sticks, and sinew-backbones; the aboriginal American pottery; the department of invertebrate fossils, which contains more than 81,000 specimens; and the department of fossil and recent botany, which has been considerably enriched. In field-work, accounts are given of explorations of stone-villages in Arizona and New Mexico—which are decided to be the work of still-existing tribes—and of studies among living Indians.

TWENTIETH ANNUAL REPORT OF THE TRUSTEES OF THE PEABODY MUSEUM OF AMERICAN ARCHÆOLOGY AND ETHNOLOGY. Professor F. W. PUTNAM, Curator. Cambridge, Mass. Pp. 74.

THE museum has now become a department of Harvard University through the recognition of Dr. Putnam, its curator, as Peabody Professor of American Archæology and Ethnology in that institution. The collections have already outgrown the capacity of the new building to fitly accommodate them, and enlargement is called for. The accessions include the Bucklin collection from ancient graves in Peru, a collection of pottery from Piura, Peru; and pottery vessels, whistles and other objects made of pottery, stone implements and carved stones, some circular and others resembling animals, from Chiriqui. The field-work included the watching of operations at the Damariscotta shell-heap, Maine, which is being removed, for human-made objects; Dr. Abbott's explorations in the Trenton gravels; mound and grave explorations in the Little Miami Valley, Ohio, where evi-

dences of the association of cremation and inhumation have been observed; Miss Fletcher's studies of living Indians and their social and religious customs; and Miss Zelia Nuttall's readings of ancient Mexican inscriptions. The present report completes the third volume, including seven years, of the series of reports. The three volumes together furnish a complete history of the institution for twenty years, and represent a great deal of archæological research.

EXPLORATIONS ON THE WEST COAST OF FLORIDA AND IN THE OKEECHOBEE WILDERNESS. By ANGELO HEILPRIN. Published by the Wagner Free Institute of Science of Philadelphia. Pp. 134, with Nineteen Plates.

THE Wagner Free Institute of Science, of whose transactions this memoir constitutes the first volume, was founded by the late William Wagner, who, after having accumulated a museum, library, and collections of apparatus, and sustained public scientific lectures for thirty years, bequeathed his property to a Board of Trustees. The Institute was incorporated in 1885, and organized a faculty of four professors, who are to give free lectures, and teach the method of, and make, research. Provision is also contemplated, when resources shall admit of them, in aid of original research, and the publication of its results. The expedition of which the present work records the results was dispatched under its auspices, with the personal co-operation of Mr. Joseph Wilcox, one of its trustees. At the time of Mr. Heilprin's visit, Florida was, in respect to geographical, zoölogical, and geological features, very nearly the least known portion of the national domain. Not even its broader geological aspects had been determined, and nearly every one believed that it was a structure of coral. Observations were conducted on the west coast as far south as the mouth of the Caloosahatchie, and thence eastward into the wilderness of Lake Okeechobee. The zoölogical researches comprised an examination of the littoral oceanic fauna and the fauna of the Okeechobee lake-region, which, in the author's belief, had not hitherto been systematically investigated. Respecting the geological character of Florida, the author concludes that the whole State belongs exclusively to the Tertiary and Post-Tertiary periods, and consequently represents the youngest portion of the United States; that there is not a particle of evidence sustaining the coral theory of the growth of the peninsula, but all the evidence points against it, and indicates that the land has been formed by the usual methods of sedimentation and upheaval; while the coral tract is limited to a border region of the south and southeast. Man's great antiquity on the peninsula is regarded as established beyond a doubt, "and not improbably the fossilized remains found on Sarasota Bay, now wholly converted into limonite, represent the most ancient belongings of man that have ever been discovered."

AN ABSTRACT OF THE OLEOMARGARINE QUESTION. Presented by the Garden City Dairy Company of Chicago. Chicago: Knight & Leonard Company. Pp. 18, legal cap.

THE object of this presentation is to point out the existing errors in national legislation on the subject, with the expectation of procuring their correction. The authors admit that legislation to regulate the manufacture of oleomargarine and guard its purity, and taxation commensurate with the taxation of other articles of trade, are proper, but contend that the present acts, being new and on a new subject, need revision; and insist that wrong motives have entered into their construction. There were three motives, they hold, that led to the adoption of the oleomargarine law: to prevent the sale or use of any poisonous or unwholesome article in the guise of butter; to require the new food-product, oleomargarine or butterine (when absolutely wholesome), to be sold honestly under its own proper name, that the consumer might know when he bought oleomargarine that he was not buying butter; and to protect "butter" by taxing oleomargarine and oleomargarine-dealers to such an extent that the business of manufacturing this new food-product might be destroyed. Concerning the first motive, they allege that "the facts show plainly that there was no occasion whatever for the enactment of the law"—there was no impure or unwholesome oleomargarine. As to the second motive, "All thinking and

reasoning men admit that the action of the law is a step in the right direction." It is to the advantage of the oleomargarine-man, for his good oleomargarine gets the credit for being what it is; while the buyer of bad butter is informed by the absence of the brand that it is not oleomargarine that he is nauseating himself with. The third motive is altogether bad; and not its least mischievous tendency is to the building up of monopolies. On account of it, the present law should be repealed, to pave the way for a consistent, comprehensive, and wholesome enactment; for its unconditional repeal without any delay "might open the way for a national act concerning the adulteration of food that would commend itself to every citizen, and meet a crying want of the times." Waiting this, the authors propose certain suggestions for the alteration and amendment of the existing legislation.

REVUE INTERNATIONALE, SCIENTIFIQUE ET POPULAIRE, DES FALSIFICATIONS DES DENRÉES ALIMENTAIRES. (International Review, Scientific and Popular, of Falsifications of Foods.) Dr. P. F. VAN HAMEL ROOS, Editor. Vol. I, No. 1. September 15, 1887. Amsterdam: Albert de Lange. Bimonthly. Pp. 32. Price, 8 francs a year.

THIS journal is established in pursuance of a suggestion which was emitted by the editor at the International Pharmaceutical and Chemical Congress of 1885, that a periodical should be published to warn people of all nations against detected adulterations, and to serve as an organ of communication among hygienists and chemists, and promote uniformity of research. The idea was well received, and Dr. Van Hamel Roos, who was at the time conducting a Dutch journal of the same character, has since been preparing to begin the work. He has secured a large list of collaborators and correspondents from most of the important countries of the world, distinguished hygienists, chemists, etc., including Dr. Willis G. Tucker, of Albany, from the United States. The present number is published in French, with a few articles in German or English also; but it is contemplated, if the clientage demands it, ultimately to publish the whole in three languages—French, German, and English. The contents of the number include papers on the measures against adulteration in force in Spain; municipal inspection of provisions at Amsterdam; international measures against adulterations (reports of the Vienna Congress on the subject); analyses of the peptones of commerce; substitutions for spices; adulteration of flour with alum; "Definition of Falsification"; and supplementary articles devoted to hygiene and industry.

BULLETIN OF THE UNITED STATES GEOLOGICAL SURVEY, NOS. 30 TO 39. Washington: Government Printing Office.

No. 30. SECOND CONTRIBUTION TO THE STUDIES ON THE CAMBRIAN FAUNAS OF NORTH AMERICA. By CHARLES D. WALCOTT. Pp. 369. Price, 25 cents.—This monograph embraces what the author designates as the "Middle Cambrian Fauna," or that which is referable to the Georgia Horizon, but including also formations in the St. Lawrence Valley, Labrador and Newfoundland; Troy, New York; and districts in the Western surveys.

No. 31. SYSTEMATIC REVIEW OF OUR PRESENT KNOWLEDGE OF FOSSIL INSECTS, INCLUDING MYRIAPODS AND ARACHNIDS. By SAMUEL H. SCUDDER. Pp. 128. Price, 15 cents.—This paper is the original form and the authorized English edition of the article which was furnished by Mr. Scudder—who is the most thorough-going of the American students in this branch of paleontology—to Dr. Zittel, for his "Handbuch der Paläontologie," and is furnished, with the concurrence of the author and publisher of that work, for the convenience of English readers.

No. 32. MINERAL SPRINGS OF THE UNITED STATES. By ALBERT C. PEALE, M. D. Pp. 235. Price, 20 cents.—This book was noticed in the "Monthly" for March, 1887.

No. 33. NOTES ON THE GEOLOGY OF NORTHERN CALIFORNIA. By J. S. DILLER. Pp. 23. Price, 5 cents.—This report embraces reconnaissances of the Cascade Range, Mount Shasta, and the Coast and Sierra Nevada Ranges in Northern California and Oregon. The surface features are grouped into two valleys—the Willamette and Sacramento—and three mountain-ranges. The limestone among the metamorphic rocks of the Coast and Sierra Nevada Ranges is referred to the Carboniferous age.

No. 34. On the relation of the Laramie Molluscan Fauna to that of the Succeeding Fresh-Water Eocene and other Groups. By Charles A. White. Pp. 32, with Plates. Price, 10 cents.—A conception of the importance of the subject of this treatise is given by the conclusion which the author expresses, that there is a complete and unbroken stratigraphical series in the region of his exploration, extending from the Middle Cretaceous to the Upper Eocene, and aggregating nearly or quite two miles in thickness. Yet, while sedimentation was not materially interrupted in a large part of the area, the aqueous life was changed, first from that of a purely marine character to that of alternating brackish and fresh waters, and finally to that of a purely fresh-water character, implying great physical changes without materially interrupting sedimentation. The author also observes that in Western North America the fresh-water deposits rival in extent and thickness the great marine formations. Each of the great lacustrine formations described by him has its own distinguishing fauna, the uniform character of which over great areas is quite remarkable.

No. 35. Physical Properties of the Iron Carburets. By Carl Barus and Vincent Strouhal. Pp. 62. Price, 10 cents. —This paper embodies reports of studies of the internal structure of tempered steel, and of the color-effects produced by slow oxidation of iron carburets.

No. 36. Subsidence of Fine Solid Particles in Liquids. By Carl Barus. Pp. 54. Price, 10 cents.—The author considers the dependence of the rate of descent upon the figure and physical constants of a single particle, or upon the constants of a stated group of particles; tries to find some expression for the dependence of subsidence on the molecular conditions of the liquid; and calls to mind the probability of certain permanent chemical effects of the liquid on the subsiding solid. A second chapter is devoted to the results of experiments upon the dependence of the rate of subsidence on the order of surface, concentration, and turbidity.

No. 37. Types of the Laramie Flora. By Lester F. Ward. Pp. 115, with Fifty-seven Plates. Price, 25 cents.—This is an enlargement of the author's "Synopsis of the Flora of the Laramie Group." The plants described and illustrated in it were collected by himself in the seasons of 1881 and 1883. The principal additions to the original work consist of descriptions of species regarded as new, and critical discussions contributing to the proper understanding of the figures and of the nature of the flora under treatment.

No. 38. Peridotite of Elliott County, Kentucky. By J. S. Diller. Pp. 31. Price, 5 cents.—This memoir concerns dikes of eruptive rock, determined as peridotite, which have been observed in Elliott County, and which the author has studied in co-operation with Professor Crandall, of the Kentucky State Geological Survey. It contains a large proportion of olivine, some of it in well-defined crystals, with proportions of pyrope and ilmenite; is associated with nearly horizontal carboniferous sandstones and shales, from which it differs widely in chemical and mineralogical constitution; and is of special interest, because it affords an instance that is rare of peridotite being found under such circumstances that its eruptive character can be fully established.

No. 39. The Upper Beaches and Deltas of the Glacial Lake Agassiz. By Warren Upham. Pp. 84. Price, 10 cents.—The name of Lake Agassiz is given to the extinct body of water which in Glacial times occupied the basin of the Red River of the North. It is assigned to the closing epoch of the Ice age. The exploration of it was begun by the author in 1879 and continued in 1881 and 1885, first under the State Geological Survey, and in the latter year under the United States Survey. The present report covers what was observed in these explorations, which were limited to the prairie regions in Minnesota and Dakota.

Aperçu de quelques Difficultés à vaincre dans la Construction du Canal de Panama. (A View of Some Difficulties to be Overcome in the Construction of the Panama Canal.) By Dr. Wolfred Nelson, of Montreal. Paris. Pp. 71. Price, 1 franc.

The author resided five years on the Isthmus of Panama, engaged in the practice of medicine, and corresponded with several newspapers, besides contributing mem-

oirs to scientific societies. He once believed in the canal, but the illusion, he says, "has fled, never to return, leaving behind a feeling of 'bitter deception.'" He expresses the firm conviction that the construction of the canal on a level, on M. de Lesseps's line, is a chimerical attempt, if not absolutely impossible. Some of his reasons for believing thus are given in this pamphlet.

SYNOPSIS OF THE FLORA OF THE LARAMIE GROUP. By LESTER F. WARD. Washington: Government Printing-Office. Pp. 160, with Thirty-four Plates.

BESIDES the object suggested in the title of this volume, the author has sought to give a few illustrations of the flora from new material, or from material more ample and abundant than has heretofore existed. The Laramie group, as described by Mr. Ward, is an extensive brackish-water deposit, situated on both sides of the Rocky Mountains, and extending from Mexico far into the British North American territory, having a breadth of hundreds of miles, and representing some four thousand feet in thickness of strata. The immense inland sea of which it is the record, and which occupied the territory now covered by the Rocky Mountains, was partially cut off from the ocean by intervening land-areas, but had one or more outlets through them communicating with the open sea which at that time occupied the territory of the lower Mississippi and lower Rio Grande Valleys. This Laramie sea existed during an immense period of time, and was finally, but very gradually, drained by the elevation of its bed, through the middle of which longitudinally the Rocky Mountains and Black Hills now run. The exact geological age in which it existed is still under discussion.

JOURNAL OF THE COLLEGE OF SCIENCE, Imperial University, Japan. Vol. I, Part III. Published by the University, Tōkyō, Japan. Pp. 124, with Nine Plates.

THE publication of such a journal as this, with communications of the character of those which it contains, largely by native Japanese scholars, is a strong testimony to the progress which European studies are making in Japan. The present part of the "Journal" contains papers on the formation of the germinal layers in Chelonia, by Professors Mitsukuri and Ishikarra; "The Caudal and Anal Fins of Goldfishes," by S. Watase; "The Giant Salamander of Japan," by Professor C. Sasaki; "A Pocket Galvanometer" and "The Constants of a Lens," by Professor A. Tanakadate; "Some Occurrences of Piedmontite in Japan," by Professor B. Koto; "The Severe Japan Earthquake of the 15th of January, 1887," by Professor Sekiya; and "Notes on the Electric Properties of Nickel and Platinum," by Professor C. G. Knott.

A QUESTAO DOS VINHOS—OS VINHOS FALSIFICADOS. (The Question of Wines—Falsified Wines.) By Dr. CAMPOS DA PAZ. Rio de Janeiro. Pp. 373.

THE author was formerly an effective member of the Central Junta of Public Hygiene, and is adjunct to the Chair of Organic and Biological Chemistry in the Faculty of Medicine at Rio Janeiro. In the present volume, he subjects the whole question of the adulteration of wines to a careful examination, with many results of analyses and experiments.

THE MICROBES OF NITRIFICATION. By MANLY MILES. Pp. 4.

ACCEPTING the agency of an organized ferment in the nitrification of plant-food, the author, forecasting the future advantages to arise from the methodical study of it, recommends that provisions be made for such study at agricultural colleges, and experiment stations, and suggests outlines of directions and methods for the studies. Further, as the roots, particularly of leguminous plants, appear to exert influence over the microbes, investigation may also be profitably pursued in that direction.

PROCEEDINGS OF THE SEVENTH ANNUAL MEETING OF THE SOCIETY FOR THE PROMOTION OF AGRICULTURAL SCIENCE. 1886. William R. Lazenby, Columbus, Ohio, Secretary. Pp. 88.

THE meeting was held in Buffalo in August, 1886. The society has so far got along without a constitution, expecting to develop one out of its experiences. In the mean time, so long as it works truly to its name, a constitution will be quite dispensable. Among the papers read at the meeting were two on the subject of dew and its

deposition, one on "Parasitic Fungi as Affecting Plant Distribution," one on "The Effects of Lime in the Soil in the Development of Plants," a list of the "Weedy Plants of Ohio," and an account of "A Contagious Disease of the European Cabbage-Worm, and its Economic Application."

THE MERIDIONAL DEFLECTION OF ICE STREAMS. By W. J. McGEE. Pp. 16.

THE moraines of certain Quaternary glaciers in the Sierras of Eastern California, show curvature or deflection in particular directions which appear independent of topographical conditions. The author's study was to find the causes of deflection. He concludes that the relation of the factors is such as to indicate the general law that ice-streams flowing upon plains are deflected toward the sides upon which effective solar accession is least; a law which appears adequate to explain the common curvature of the moraines of the Sierras.

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The New Age. Weekly. London. Pp. 12. One penny.

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Guy, George L. Annual Presidential Address of the Southern Illinois Teachers' Association. Mount Carmel, Ill. Pp. 23.

Massachusetts Agricultural College, 1862–1887. Amherst, Mass. Pp. 61.

Tuckerman, Frederick. The Tongue and Gustatory Organs of Mephitus Mephitica. London: Adlard & Son. Pp. 51, with Plates.

Donaldson, William M., & Co., Chicago. Calendars, 1888.

Hague, Arnold. Notes on the Deposition of Scorodite and on Arsenical Waters in the Yellowstone National Park. Pp. 5

New York Association for Improving the Condition of the Poor. Forty-fourth Annual Report, 1887. Pp. 46.

Remsen, Ira. The Principles of Theoretical Chemistry, with Special Reference to the Constitution of Chemical Compounds. Third edition. Philadelphia: Lea Brothers & Co. Pp. 318. $2.

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Wood, Henry. Natural Law in the Business World. Pamphlet edition. Boston: Lee & Shepard; New York: Charles T. Dillingham. Pp. 222. 30 cents.

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Froebel, Friedrich. The Education of Man. Translated and Annotated by W. N. Hailmann. New York: D. Appleton & Co. Pp. 322. $1.50.

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POPULAR MISCELLANY.

The Scientific Department of Brown University.—Brown University holds a respectable rank with the other colleges in this country of the same grade in its scientific department. Several of its officers of instruction who, in previous years, have filled chairs in this department achieved both success and reputation, and their names are well known in the circles of scientific men. It implies no invidious distinction to make special mention of the names of President Alexis Caswell and Professor George Ide Chace, the former well known in the Department of Natural Philosophy and Astronomy, and the latter in that of Chemistry. In the year 1850, under the presidency of Dr. Wayland, the university entered upon the trial of an experiment which was the result of the thoughtful deliberation of the distinguished head of the institution. The sum of one hundred and twenty-five thousand dollars was raised, chiefly among the citizens of Providence, so that the new order of things might start on a good financial basis. The radical changes in the proposed methods in carrying on college education was severely criticised by what may be called the conservative press of the country. On the other hand, the secular press, with great unanimity, hailed the movement as one eminently adapted to meet the demands of the age, that education should be brought nearer to the masses, and be better fitted to prepare men for the practical work of every-day life. From the very outset, the adoption of the new plan was followed by a large increase of zeal and thorough devotion to study in the scientific department of the university, and an impetus was given to this department, which, down to the present hour, has never lost its force. Aiming especially to reach and benefit the working-classes, first of all, by training men who, in due time, would be qualified to give instruction to such as sought it in the common walks of life, the projector of the plan wished to go beyond the narrow limits bounded by college walls, and in some way bring the university in direct contact with the producing portion of the community. Accordingly, it was arranged to give a course of lectures upon "The Principles and Processes employed in Calico Printing." Subsequently, Professor Chace delivered eight lectures upon "The Chemistry of the Precious Metals" to jewelers and other workers in those metals. An audience of between three and four hundred, filling Rhode Island Hall, listened with the greatest delight and profit to these lectures. The sentiments of this large body of respectable mechanics found a response in the remark of one of their number: "I see why it is that I have so often failed. I have been doing or trying to do these things all my life, without knowing *why*." The history of the scientific department of the university for nearly forty years is one of constant progress. The chairs of two professorships, that of Chemistry and that of Physics, have been placed on generous pecuniary foundations, and men of marked ability are filling these chairs. By the will of George F. Wilson the fund of one hundred thousand dollars has been paid into the treasury for the Department of Physics. Sixty or seventy thousand dollars of this bequest is to be appropriated to the erection of a physical laboratory. The income of ten thousand dollars is to be used for maintaining the equipment of the laboratory, and the income from the balance of the bequest

goes to pay the salary of an assistant. The Department of Chemistry under the charge of Professor John Howard Appleton is in a healthy condition. The same may be said of the Department of Zoölogy and Geology, under Professor A. S. Packard, and that of Astronomy under Professor Winslow Upton. Excellent work is done in all these departments, and young men who may be attracted to the university with the hope of being well trained in courses of collegiate study which accord with their tastes, and such as will fit them for the sort of professional life to which their inclinations lead them, will be sure not to be disappointed.

English Literary Piracy.—As a sample of high-minded journalism in a country where there is a great deal of righteous indignation over the ways of American publishers, we give below a list of original articles and special translations reprinted from this magazine during the past year, *without any credit whatever*, in a London journal called *Health*, of which Dr. Andrew Wilson, F. R. S. E., is the editor. American periodicals in good standing uniformly give full credit for articles from foreign sources which they republish. *The Popular Science Monthly* has never violated this custom, and desires the same measure of justice from its foreign contemporaries:

"A Bald and Toothless Future," *P. S. M.* Oct., 1886; *Health*, Jan. 28.

"Vinegar and its Mother," *P. S. M.* Jan., 1887; *Health*, May 6, 13, and 20.

"Hats as a Cause of Baldness," *P. S. M.* May, 1887; *Health*, May 20.

"Hygiene as a Basis of Morals," *P. S. M.* May, 1887; *Health*, June 10, 17, 24, and July 1.

"Glasgow's Bandy-Legged Children," *P. S. M.*, July, 1884; *Health*, July 8.

"Brain-forcing in Childhood," *P. S. M.*, April, 1887; *Health*, July 8, 15, 22, and 29.

"Variations in Human Stature." (Translated for the *P. S. M.* from *La Nature.*) *P. S. M.*, July, 1887; *Health*, July 29, and Aug. 12.

"Physiology of Freezing." (Translated for the *P. S. M.* from *Die Gartenlaube.*) *P. S. M.*, Sept., 1887; *Health*, Sept. 16 and 23.

"Human Brain-weights," *P. S. M.*, July, 1887; *Health*, Sept. 30.

"Hats and Baldness," *P. S. M.*, Oct., 1887; *Health*, Nov. 18.

Centralization in School-Life.—James P. Applegate, editor of the New Albany, Indiana, "Ledger," in an address before an Editorial Association, considering the evils of the centralizing tendencies of the times, traced their origin to the public schools, when he said: "Teaching and learning have been reduced to a mathematical system and work with the regularity of machinery. Given so much room, so many pupils, so many hours, so many studies, so many pages of each, so many months in one department, so many in another; one class goes into the hopper at one end and goes out at the other. No matter if one head is larger or smaller than another, the brain brighter or duller, the body stronger or weaker, all is grist that goes to that mill and it is all ground with the same burrs. This system produces a certain order of general average intelligence, higher, perhaps, than existed in the days when boys and girls, not classes, were taught, but where are the individual scholars? Passing through the public schools the student, if further pursuing his studies, goes to college, and there the routine, while of a higher order is the same in principle, all class and grade individuality is lost. Do the graduates of our colleges go out as well educated as their forefathers? The average is higher, no doubt, but are they individually as well equipped for the battles of life?"

The International Competitive Exhibition at Brussels.—A great International Competition of Sciences and Industry is to be held, together with a Universal Exhibition, at Brussels, Belgium, during 1888. All products and documents meeting some want or constituting and illustrating progress, are admissible. Money-prizes, medals, and diplomas will be distributed to the value of 500,000 francs, or about $100,000. A circular in the department of "Operating of Mines" describes the subdivisions or classes in which exhibitors in that branch are invited to compete. The first includes the boring of wells and galleries, particularly in wet and loose grounds, with the best methods and appliances for the same;

the safest explosives, processes for avoiding as far as possible the use of explosives, and supports. The second subdivision includes ventilation and lighting, with precautions against fire-damp explosions and the resultant damage. In the third class are invited treatises and plans with reference to the removal of water, extraction, hauling, and loading of the products, and the transportation of the workmen in the shafts. The fourth class embraces the mechanical preparation of the mineral products, manufacture of coke and agglomerated matter, and processes of treatment for burning turf so as to increase its value. The fifth class relates to plans and maps of the subterranean works, provisions against accidents, measures for the saving, relief, and care of the workmen when they occur, institutions for the benefit of workmen in mines, and statistics. In the sixth class are included processes and working-stock for the operating of quarries; and in the seventh class, comparisons of the stones and marbles of different countries, and exhibits of Belgian stones and marbles adapted to all the different purposes of use. Applications should be filed before January 15, and entries made before April 15, 1888, with Armstrong, Knauer & Co., authorized agents, 822 and 824 Broadway, New York.

What can he do?—The great test in life, says General Thomas J. Morgan, in a paper on "Training as an Element of Education," is rather what a man can do than what he knows. Can he use his eyes? Has he good judgment? Is he a man of common sense? Can he think? Does he reason correctly? Has he power of adaptation? Can he organize? Has he executive force? Is he practical? These are the kind of test-questions that are put to the graduates of our schools. Can the "sweet girl graduate" cook a dinner, sweep a room, or superintend a house? Does she have an intelligent interest in passing events? Has she robust health, good habits, self-reliance, energy, and power of endurance? Can the young man lay aside his diploma and keep his father's accounts, write an article for the newspaper, make a business-trip to Chicago, give an intelligent account of the morning's news? Can he lend a hand at home, and turn to some good account in the daily duties of life some of the accumulated stores of knowledge amassed in years of study? Does his education render him more industrious, more skillful and efficient, more ingenious, more persistent, more practically masterful in whatever he undertakes? If he has been trained to use his senses, to acquaint himself with natural phenomena at first hand; if he has been taught to think, to make careful comparison, noting essential differences and significant similarities, making patient inductions and wise generalizations; if he has been led to form fixed habits of thoughtfulness, self-reliance, moral earnestness, inflexibility of purpose, persistent industry, promptness, punctuality, fidelity, unswerving devotion to duty; if, in short, as a result of his school-life, his training has produced a well-rounded character, he will be able to meet all the reasonable demands that society can make upon one who lacks practical experience in actual business. He will readily acquire skill and efficiency in any calling for which his special talents have fitted him. Training gives potency to all the soul's possibilities.

Counterfeiting Gems.—The closest imitations of diamonds and other precious stones can be made out of a mixture of violin-glass and borax. A London lapidary once testified in court that he made all his imitations out of real stones, by taking pale, cheap stones, splitting them, introducing a deeper tone of color, and joining them again, whereby the salable value of the stones was considerably increased. Diamonds are often split, and each half of the gem is made to do duty on a paste foundation on which it has been carefully mounted. The operator then has two gems, at two prices. One Zocolind was accustomed to procure a very thin flake of an inferior example of the stone he wished to "improve," choosing those which had little color. As a bottom for his "make up" he took a bit of crystal which he had shaped for his purpose; covering this with a transparent glue properly colored, he fixed on the flake, and then concealed the joining so well in the setting that customers could be deceived into believing that they had very fine stones. Varieties of the topax and other stones are

often cut and polished and palmed off as diamonds; but this material is costly. A composition for rubies is made of five hundred parts of strass—a specially manufactured glass—twenty parts of glass of antimony, and a half-part each of purple of Cassius and gold. Mock pearls are sometimes very deceptive in appearance, but they can usually be detected by comparison with the real gem, by their brittleness, or by the clumsy and blunt-edged appearance of the drill-holes, which are usually perfect in the real pearls. The scales of a small fish known as the bleak have been used in the formation of false pearls; but as it requires some eighteen thousand of these fish to provide one-pound weight of the pearl-making material, the manufacture is not likely to become extensive.

Preventable Loss in Agriculture.—In a British Association paper on this subject, Professor W. Freame first described the uncontrollable losses which were chiefly such as were determined by meteorological conditions. These, if they could not be anticipated, might to some extent be mitigated by acting upon the recorded practice which had been found most beneficial in similar cases in previous years. Hence the value of such records. Controllable losses were such as might reasonably be anticipated, and therefore provided against, and should be in a very high degree, although not absolutely, preventable. The toleration of such preventable losses might be attributed partly to ignorance, partly to indifference, and partly to empiricism. First among the sources of preventable loss was the imperfect working of the soil, which was a common cause of poor crops in the immediate future and of worse trouble farther on. Another source was the use of bad seed. No greater folly could be conceived than that of introducing upon the land by means of purchased seeds the seeds of weeds and parasites. The most objectionable rubbish was sometimes sown, and heavy expenses were in consequence subsequently incurred. A third source was the encouragement of weeds, of which the most common species were grown at immense cost to the farmer. They robbed him just as much as a pickpocket did who stole his purse. His object was, or should be, to concentrate all the capacities of the soil upon the production of useful crops; every weed that was grown detracted from this purpose. Ignorance of the properties and affinities of weeds was just as deplorable. Some—the cruciferous weeds, for example—harbored and encouraged insect pests till the cruciferous crop they were waiting for was ready to be devoured and destroyed by them. Another source of loss was the deterioration of grass-lands. There were in the British Islands nearly thirty-three million acres of permanent or temporary grass land, which was equivalent to three sevenths of the entire area. Yet, as to the nature of the herbage growing upon this enormous area, ninety-nine farmers out of one hundred were in entire ignorance. A fifth source was from pests. The maintenance of insect-thieves sometimes constituted a severe drain upon farming capital. Yet in no part of his education was the farmer called upon to familiarize himself with the habits of these creatures. Of fungi pests, his knowledge was, if it were possible, even less. Other sources were diseases of live-stock, some of which were preventable and some greatly reduced, while others stood in need of further investigation; and injudicious expenditure. Among the most practicable remedies for these preventable losses, and a means, therefore, for making agriculture a more profitable occupation, was the extension of sound technical instruction in agriculture.

Photography as an Aid to Astronomy.—Mr. A. A. Common believes that some astronomical objects can be studied to better advantage in photographs than in themselves. The brain can not always take in the perceptions of the eye fast enough, and the eye is not sensitive to images whose brightness falls below a certain limit. In photography, a prolonged exposure may be made to compensate for deficiency in luminous power; and the sensitive plate being competent to respond to quicker vibrations than the eye, it is possible to obtain photographs of celestial objects radiating light which the eye is not adapted to receive. While the moon has received much attention, the photographs of it taken by Rutherford, twenty years ago, have not been su-

perseded. The power of photography to portray the nebulæ has been thoroughly demonstrated. The art has been applied to the observation of comets, and may yet be brought into play for the paths of meteors, the discovery of new planets, and other purposes now hardly thought of. After remaining nearly stationary for years, "at a bound it has gone far beyond anything that was expected of it, and bids fair to overturn a good deal of the practice that has hitherto existed among astronomers."

Indian Villages in New York.—In his American Association paper on "Aboriginal Villages in New York State," Dr. W. M. Beauchamp traversed the famous theories of Mr. Lewis H. Morgan of the "long houses" of the Iroquois. In the highlands, he said, forts were commonly long and narrow, often two or three times as long as wide, and usually with the houses in the narrow part, leaving the wider portion for public uses and games. The long house was not peculiar to the Iroquois, nor prominent among them, and facts in this matter have yielded to theories. Greenhalgh noticed these large lodges in only one town, and Morgan's estimate would give that town five times the whole Seneca population. The traveler's account gave but an average of two or three warriors to a lodge throughout the five nations. The form of the forts often afforded but little room for long houses, especially in those examined by the author. Among the Iroquois they do not prove communal life. Early writers often refer to ownership of fields, and Sir William Johnson said that every nation and tribe had its own district and well-known portion of land.

Trees for Plantation around Houses.—Dr. Charles Roberts, considering the subject from the sanitary point of view, advises that while belts of trees may be planted on the northern and eastern aspects of houses, on the east side the trees should not be so near nor so high as to keep the morning sun from the bedroom windows in the shorter days. On the southern and western aspects of the house isolated trees only should be permitted, so that there may be free access of the sunshine and the west winds to the house and grounds. Pine trees are the best of all trees to plant near the house, as they collect the greatest amount of rainfall, and permit the freest evaporation from the ground. Acacias, oaks, and birches are late to burst into leaf, and therefore allow the ground to be warmed by the sun's rays in early spring. The elm, lime, and chestnut are the least desirable trees to plant near houses, although they are the most common. They both come into leaf and cast their leaves early, so that they exclude the spring sun and do not afford much shade in the hot autumn months, when it is most required. Trees are often useful guides to the selection of residences. Numerous trees with rich foliage and a rank growth of ferns or moss indicate a damp, stagnant atmosphere; while abundance of flowers and fruit imply a dry, sunny climate. Pines and birches indicate a dry, rocky, sandy, or gravelly soil; beeches, a dryish, chalky, or gravelly soil; elms and limes, a rich and somewhat damp soil; oaks and ashes, a heavy clay soil; and poplars and willows, a low, damp, or marshy soil. Many of these trees are found growing together, and it is only when one species predominates in number and vigor that it is truly characteristic of the soil and that part of the atmosphere in connection with it.

The Cross Timbers of Texas. — The "Cross Timbers" of Texas are two long and narrow strips of forest region between the ninety-sixth and ninety-ninth meridians, extending parallel to each other from the Indian Territory southward to the central portion of the State, and forming a marked exception to the usual prairie features of the country. They are about fifteen miles wide, and fifty miles apart, and are separated by a timberless prairie region. Both are lower in level than the country through which they extend. The western strip, because it is higher in position, though geologically lower, is called the upper, and the eastern strip the lower cross timber. The soil in both is sandy, but that of the eastern strip is less siliceous, with some iron, is considerably more fertile than that of the western, and shows corresponding differences in its vegetation. Various theories have been proposed to account for the existence of these woodlands—among them, that they

represent rivers or inlets of the Tertiary sea; that they are the beds of extinct lakes; and that they represent the beds of Quaternary rivers. Mr. R. T. Hill, who has made a geological examination of the region, finds all these theories wrong. He sees in the ground on which the timbers grow, the detritus of arenaceous strata which occupy well-defined horizons in the geologic series, and which have been exposed by the denudation of the overlying strata. The timber confines itself to these arenaceous belts because they afford a suitable matrix for the penetration of the roots of trees and a constant reservoir for moisture; while "the barrenness of the prairies, so far as forest growth is concerned, is owing to the absence of the requisite structural conditions for preservation of moisture as well as to the excess of carbonate of lime in their soils."

Injuries caused by Parasitic Fungi.—The injuries which parasitic fungi produce upon their host plants, were described in the American Association by A. B. Seymour. Parasites take away the nutriment of the plants, killing or continually absorbing the food-supply of individual cells, and injuring cell-walls. They impair the power of assimilation, weaken the physiological power, causing the formation of spots and of black molds to obstruct the passage of light. Some fungi cause a change of position in their host, and less favorable exposure. They provoke abnormal acceleration or retardation of growth, with resultant distortion and impaired vitality. Any part of the plant may be affected. In many grasses the entire inflorescence is destroyed. Decay is produced in ripe fruits, and valuable plants become infected with disease from less valuable ones. The extent of the injury attributable to any one cause is hard to determine, because several causes act together.

Deceptive Sensations.—The evidence of our senses is correct in nearly all cases in which two of them are called into play, so that the testimony of one is checked by that of the other. But when we have to rely upon one sense alone, we are sometimes liable to curious deceptions. This is the case with some of the feelings of touch. In hip-joint disease the pain is often referred to the knee, while it is really in the hip. This is because the nerve which conveys sensation from the knee, also sends a branch to the hip-joint. The experiences of those who have lost a limb are familiar. For some time afterward they feel sensations and pains of all sorts in the member that is gone, so that they can hardly convince themselves that it is not still there, itching or aching or smarting. This is because the nerve which used to convey feeling to the lost extremity is affected by some temporary accident. The feeling, which may be real, as to the trunk that remains, is still, by force of habit, referred to the extremity whence it used to come. Another experiment in deceptive sensations may be made by crossing the second finger over the first, and then placing a marble between the tips of the fingers, when it will be almost impossible to convince one's self that there are not two marbles. This is because two points in the fingers are touched simultaneously, which in the ordinary position could only be touched at the same time by two marbles. Acting upon its previous knowledge, the brain says that there are two.

Relative Mortality of Social Classes.—Mr. Noel A. Humphreys, in a paper on the relative mortality among the different classes in society, after citing the general evidence of the British life-tables that the mean duration of life has perceptibly and steadily increased in recent years, shows that this factor is mainly controlled by the rate of mortality in childhood; and the expectation of life is regarded in the life-tables as greater at ten years of age than it is at birth. Subsequently to childhood, the greater vitality of the upper and middle classes, compared with that of the general population, is only somewhat less marked than it is at under five years of age. The statistics of mortality, according to occupation, show a great difference in favor of quiet pursuits, and, among workingmen, of those engaged in the country as against those occupied in cities. Many of these differences are doubtless due more to the influences and risks of occupation than to the mere influence of

class; and the differences between rural and urban laborers to differences of housing and sanitary surroundings; for both classes probably suffer about equally from poverty, hard work, and hard living. The great reduction in the rate of mortality among the inhabitants of the Peabody buildings, as compared with other tenement-house dwellers, points to one method of bringing the mortality of the working-classes within sanitary control. These and other similar facts indicate further reductions in the now rapidly declining English death-rate, the possible extent of which it is not easy to estimate.

Glaciation on the Pacific Coast.—Mr. G. Frederick Wright has, in the "American Naturalist," some notes on the "Glaciation of the Pacific Coast in Oregon and Washington Territory." At Sims's Station, Dakota, forty miles west of Bismarck, the passage from the glaciated to the unglaciated region is quite marked, and can easily be detected from the train. The next signs of glaciation are near Lake Pend Oreille, in Idaho, water-worn pebbles from whence are observed in old water-courses far down in Eastern Washington Territory. West of the Cascade Mountains, all the streams coming down from Mount Rainier and its companions are heavily charged with glacial mud, and can be traced to extensive glaciers in the mountains. The largest of them, White River glacier, on the north side, is from one to one and a half mile wide at its termination at about five thousand feet above tide, is about ten miles long, and in its higher level merges in the general ice-cap which envelops the upper five thousand feet of the mountain. The shores and islands of Puget Sound have every appearance of being a true glacial accumulation, while the north shore of the Strait of Juan de Fuca, near Victoria on Vancouver's Island, is remarkably clear of glacial *débris;* the rocks near Victoria exhibit some of the most remarkable effects of glacial scoring and striation anywhere to be found. About thirty-five miles up the Stikine River, two glaciers of immense size are encountered coming down, one from the north and one from the south, to the vicinity of the vast cañon through which the river runs. It is clear from observation of the situation that a comparatively slight extension of these two glaciers would make them unite and close up the mouth of the river; and the Indians have a tradition that within historic times these glaciers met and the Stikine River made its way under them through an immense tunnel. From the mouth of the Stikine River northward, glaciers in great numbers and of great size are seen coming down from the mountains toward the sea-level, while all the mountains upon the islands are snow-clad through the whole summer, and some of them contain glaciers of small size. At the head of Glacier Bay no less than four glaciers of great size come down to tide-level, sending off immense numbers of small fragments and bergs. The evidence here of the vast extension of these glaciers down the bay, and of the facility of glacier-ice in adjusting itself to the local topography, is of the most explicit and interesting character. The present formation of glaciers on the coast of Southwestern Alaska is favored not so much by the coolness of the climate as by the elevation of the mountains, and the excessive amount of precipitation. There is no evidence that the elevation of the coast has materially changed in recent times. Nor is there evidence of any changes in the amount of precipitation. It would only be necessary to suppose a slight diminution of temperature to secure all the additional force required to extend the present glaciers of Southeastern Alaska, British Columbia, and of the Cascade Range in Washington Territory and Oregon, far down into the South, where the marks of former glacial action are now seen.

The Use of a Snake's Rattle.—The purpose of the rattlesnake's rattle has been the subject of much speculation. Mr. O. P. Hay, in the "American Naturalist," thinks that it is a warning to approaching enemies to keep them away. The warning must have been very efficient with most animals. The snakes are, of course, in great danger of being trodden upon by animals which do not intend directly to attack them—buffaloes, for instance—and to attempt war on a herd of large animals would be useless. But through the simple device of sounding the rattle, each animal as it approached would

be warned of the presence of the snake, and would probably be induced to give it abundant space. Doubtless, by this means, the snakes have been saved from many a rude tread by bear or wolf or panther that would have been unpleasant to them, and might have involved them in a fight in which they had everything to lose and nothing to gain.

Mineral Fibers.—Mr. C. V. Boys, describing in the Physical Society in London "The Production, Preparation, and Properties of the Finest Fibers," said that in producing very fine glass-fibers, he found it best to use very small quantities at high temperatures, with a velocity of separation as great as possible. In the last point, the best results are given by a cross-bow and straw arrow, to the tail of which a thin rod of the substance to be drawn is cemented. By this means, fibers of glass less than $\frac{1}{10000}$ of an inch in diameter can be made. The author had also experimented on many minerals, with more or less success. Ruby, sapphire, and fluor-spar could not well be drawn into fibers, but quartz, augite, and feldspar gave very satisfactory results. Garnet, when treated at low temperatures, yielded fibers exhibiting the most beautiful colors. From quartz, fibers less than $\frac{1}{100000}$ of an inch in diameter had been obtained. The thread can not be drawn directly from the crystal, but the latter has to be slowly heated, fused, and cast in a thin rod. Quartz-fiber seems to be free from the torsional fatigue so evident in glass and metallic fibers, and is therefore valuable for instruments requiring torsional control. The tenacity of such fibers is about fifty tons on the square inch.

Photographing Birds.—Dr. R. W. Shufeldt suggests, in "The Auk," to ornithologists that they may find a portable photographic outfit of advantage in their studies. He finds that by the use of the instantaneous shutter, birds may be photographed in nearly all of their positions. "Out here on the prairies we will often find an old stump or stalk upon which a dozen or fifteen species of birds will alight during seven or eight hours, on almost any day suitable to use the camera upon them. Now, all we have to do is properly to set up our instrument near this point, conceal it in such a way as not to alarm the birds, focus it sharply upon the perch where they alight, place on your 'snap-shutter,' and fix it with a string, and then remove yourself far enough away to pull it when you have a subject sitting to your liking. Birds that you have wounded but slightly may be photographed under the most favorable circumstances; they may also be taken sitting on their nests; in actual flight, however swift; in pursuit of their food; in leading about their young; indeed, the list is almost an endless one. Rookeries also offer admirable subjects, and a splendid field is open at those wonderful resorts of water-birds in such places as the Bahamas or the Alaskan coasts."

NOTES.

THE Leander McCormick Observatory of the University of Virginia, Professor Ormond Stone, director, devoted much attention last year to the nebula of Orion, in which the director believes that the principal changes going on are of brightness. Besides these, three hundred and fifty-one observations of miscellaneous nebulæ have been made, resulting in a large number of sketches, and in the discovery of two hundred and seventy nebulæ which are supposed not to have been hitherto detected. A working-list of all known nebulæ north of thirty degrees south declination, which are as bright as the fourteenth magnitude, has been made to aid in the determination of nebular motions. Three independent publications have been issued, and six articles published in astronomical periodicals.

THE recent Manchester meeting of the British Association appears to have been one of the most successful that was ever held. It was said, at the close of the proceedings, that Manchester had surpassed all other places visited by the Association, alike in the numbers attending, the amount received in subscriptions, and the amount which the Association in its turn was enabled to vote for scientific research.

A COMMITTEE was appointed by the Chemical Section of the British Association, at the Manchester meeting, 1887, to inquire into and report upon the methods adopted for teaching chemistry in the various schools. It consists of the representatives of the universities and colleges, schools and technical institutions in which chemistry is taught. This action was taken after expressions of dissatisfaction in a discussion

on the subject, with the present methods of teaching the science, and of the desire for important changes.

Mr. T. Mellard Reade has projected a new theory of the origin of mountains, which contradicts all the other theories. Having shown that periods of great sedimentary deposit precede the birth of every large mountain-chain, he supposes, as Babbage has proved, that a great elevation of temperature ensues, producing expansions of the strata. These being prevented from spreading horizontally by the rigid mass of the earth's crust that bounds the local area, can only swell upward and cause those ridges which we know as mountains. The author has tried experiments in the mechanical effects of expansion by heat on various rocks, and has found a similar result in miniature produced upon them.

Barrels are made in Jersey for the use of the Channel Islands farmers which will fold up when empty, and thus, having been sent to market, can be packed into a small space on the return. The staves are fixed upon the hoops so that, the heads being removed, they may be rolled up. They are made perfect cylinders, and therefore occupy less space for the same capacity than ordinary barrels.

Sir James Paget spoke at a school festival, some time ago, of the importance of "learning how to learn," and showed that knowledge not immediately useful in itself may be the means of developing the power of learning in the mind acquiring it. The cultivation of the faculty of knowing is of incomparably greater importance than the mere acquisition of knowledge; and to the student this faculty, so developed that when need arises, knowledge may be quickly obtained, is a better provision for the business of life than is afforded by the largest and richest stores of information packed away in the memory; thus the brain-property most worth carrying about is the power of finding at pleasnre and learning at will precisely what is wanted.

Oyster-culture has had a great development in France. Thus, while in 1857 there were in the Bay of Arcachon twenty parks, or district oyster-beds, in 1865 there were 297 beds, producing 10,000,000 oysters annually; and there are now 15,000 acres of beds, yielding an annual supply of 300,000,000 oysters. From Auray, on the coast of Brittany, 7,000,000 oysters were sent to market in 1876–'77; in 1885, the numbers exceeded 70,000,000. On the other hand, the British oyster-industry has declined; and the coast which furnished ancient Rome with oysters, and within a generation exported then to Paris, now ranks low in the list of oyster-nurseries.

The recent International Hygienic Congress at Vienna was attended by twenty-two hundred and fifty members. M. Brouardel spoke upon typhoid fever, which he said was a far more dangerous disease to man than cholera. Concerning its origin—whether from the decomposition of organic matter or from specific virus—there was still an open question. Herr Pettenkofer, in a lecture on hygienic instruction in universities and technical schools, dwelt on the necessity of spreading hygienic principles among all classes of society. He referred to the statistics of mortality of London as showing how hygienic piety there had been rewarded.

The climate of the Sandwich Islands is peculiarly adapted to the cultivation of rice of a superior quality and in great quantity, its evenness of temperature permitting the raising of two crops a year without any particular strain upon the soil. The crops are raised in fields called patches, most of which were formerly used by the natives for raising *taro*, and which are often not more than an acre in extent. The fields are situated in the lowlands, where abundant irrigation can be obtained, and sometimes on slight elevations where artesian wells can be successfully established, and are the highest-priced lands in the kingdom. The cultivation is almost entirely in the hands of the Chinese.

Mr. Mayall, a London photographer, claims to have perfected a system of photography in colors. He takes a negative on a specially sensitized plate; from this a positive is produced on a chemically treated basis by the aid of a solar camera and a spectroscopic arrangement. The image is produced in colors on the basis without the aid of hand-work or brush. The colors are said to be all hydrocarbons, specially prepared and capable of subdivision to the 180-millionth of an inch. When the colored picture is produced by chemical action, the image exists between two films not more than the hundredth part of an inch in thickness. These photographs are said to be permanent and not affected by climate.

M. Wiecyk has observed that the workmen in the petroleum-mines of the Carpathians, having to breathe an air contaminated with various hydrocarbons, carbonic acid and oxide, and sulphureted hydrogen, are not rarely subject to asphyxia. They are also exposed to tingling in the ears, dazzling, beating of the arteries of the head, syncopes, and hallucinations of usually an agreeable character. The respiration of petroleum-vapors induces at first feelings of lightness in the breast and greater freedom in breathing, but in the end palpitations and general weakness. The rareness of consumption and infectious and epidemic diseases among the workmen is remarked upon.

M. Olszewski has, by the aid of excessively low temperatures, liquefied the more permanent gases at pressures averaging only 740 millimetres, and has also determined the boiling-points, melting-points, and densities at atmospheric pressure. The boiling-points have thus been determined: Of methane, —164° centigrade; oxygen, —181·4°; —nitrogen, —194·4°; carbon monoxide, —190°; and nitric oxide, —153·6°. The melting-point of carbon monoxide was also determined to be —207°, and that of nitrogen —214°. M. Olszewski's nearest approach to absolute zero was —225° C., or —373° Fahr., for solid nitrogen. The density of methane at 736 mm. and —164° C., was found to be 0·415; that of oxygen at 743 mm., and —181·4° was 1·124; and that of nitrogen at 741 mm. and —194·4° was 0·885.

Professor Schnetzler has described a curious moss which grows at the depth of two hundred feet in the sub-lacustrine moraine of Yvoire. It contains grains of chlorophyl perfectly formed.

OBITUARY NOTES.

Count August von Marschall, Director of the Archives of the Geologische Reichanstalt of Vienna, died recently near that city, at the age of eighty-two years. He was the author of several scientific works.

Oscar Harger, Assistant Professor of Paleontology in Yale College, died in New Haven, November 6. He was born in 1843, was graduated from Yale in 1878, and, having devoted himself to the study of Natural History, became a co-worker with Professor Marsh. He was on the staff of the dredging expedition of the coast-survey steamer Bach to St. George's Banks in 1871, and accompanied Professor Marsh on his geological expeditions in 1871 and 1873. Among his contributions to scientific literature were the catalogue of isopods in Verril and Smith's "Invertebrata of Southern New England," and "A Report on the Marine Isopoda of New England and Adjacent Waters."

M. H. Bayard, who recently died in Paris at the age of eighty-one years, discovered a photographic process, in 1839, almost simultaneously with Daguerre and Talbot. He delayed to perfect and publish his discovery and thereby lost the priority which it is asserted he might easily have claimed.

The death is reported of Dr. E. Luther, Professor of Astronomy and Director of the Observatory at Königsberg, Germany, in the eighty-first year of his age.

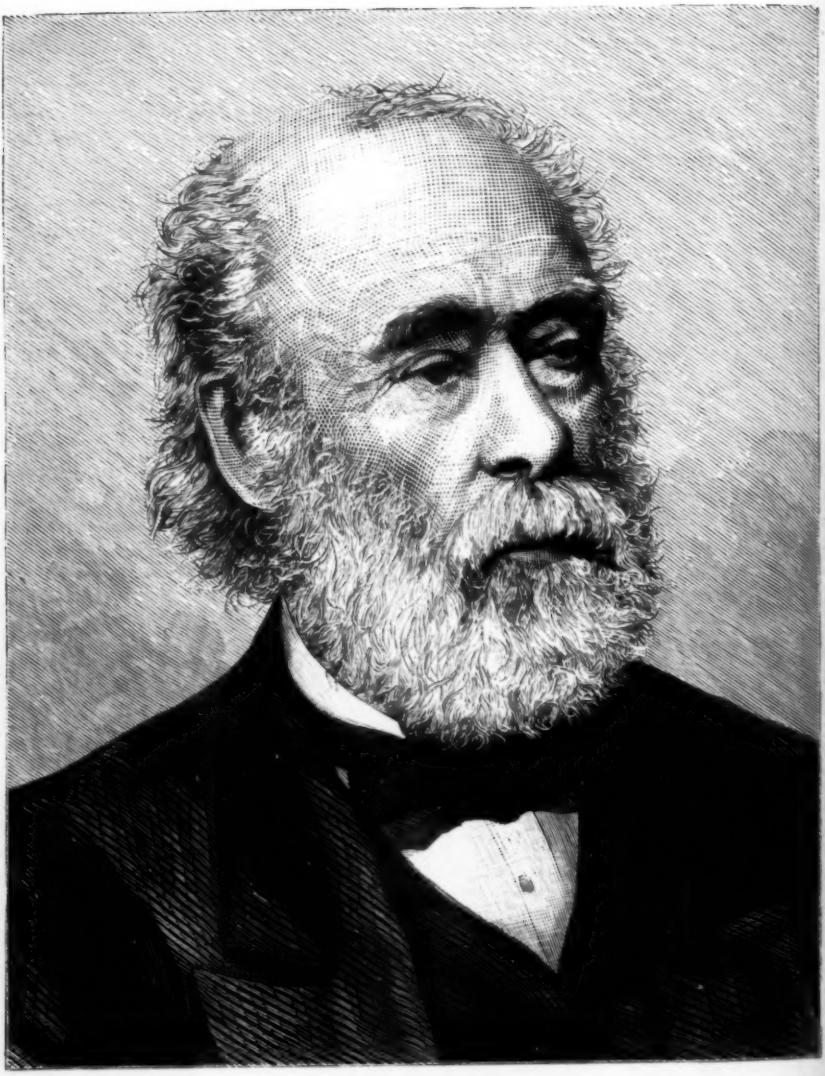
Dr. Robert Caspary, Professor of Botany in the University of Königaberg, died recently from the effects of a fall downstairs. He was born in 1818, and, while not a prolific writer, was well known to botanists as a critical authority on Nymphæaceæ.

The Rev. William S. Symonds, F.G.S., rector of Pendock, who died September 15, was an earnest student of British geology, and contributed papers to the scientific periodicals on the rocks and fossils of the west of England. He paid, however, more attention to physical geology than to paleontology; and was greatly interested in the phenomena of the glacial drifts, and in questions relating to the antiquity of prehistoric man. He was the author of "Records of the Rocks," "Old Stones," and "Old Bones," of more than forty papers in scientific journals, and of the romances "Malvern Chase" and "Hornby Castle."

Joseph Maxendell, a British meteorologist and astronomer of eminent local reputation, died in Southport, October 7, in the seventy-second year of his age. He is declared by Balfour Stewart to have been the pioneer in the suggestion of the eleven-year sun-spot theory of meteorological cycles, and to have been the first to propose the use of storm-signals as they are now adopted by all maritime nations. He was a member of many learned societies at home and abroad.

Robert Hunt, F. R. S., keeper of the British Mining Records, died October 17, in the eighty-first year of his age. He had been writing on scientific subjects for nearly fifty years. While a medical student, he became acquainted with pharmaceutical chemistry. During a walking tour, he collected the materials for a book on west of England folk-lore. He studied and wrote upon photography, crystallization, the chemical action of light (in relation to which he introduced the term actinism), the influence of colored media on plant-germination and growth, and other kindred subjects. He was the originator of the publication of statistical returns of the mineral produce of the United Kingdom; and in 1866 was one of the commissioners to inquire into the stock of unworked coal in the mines. He published, in 1884, a comprehensive book on British mining. He was author of works on the "Poetry of Science," "Panthea, or the Spirit of Nature," and "Handbooks" of the great Exhibitions of 1851 and 1852; and he edited, after Dr. Ure's death, the successive editions of that author's "Dictionary of Arts."

Mr. Thomas Bolton, of the Microscopists' and Naturalists' Studio, Birmingham, England, died November 7th. His services as a naturalist and microscopist were recognized several months ago by the award of a civil-service medal, in connection with which a memorial, signed by many eminent men of science, was presented, setting forth his claims and discoveries.



SIR JOSEPH WHITWORTH.